ARCHIVES of OPHTHALMOLOGY

VOLUME 13 (old series Volume 70) MARCH 1935 NUMBER 3

TRANSPLANTATION OF THE CORNEA

PROF. V. P. FILATOV

ODESSA, U. S. S. R.

EDITED BY DR. OLGA SITCHEVSKA, NEW YORK

It is my aim in the present article to offer to my colleagues only my personal experience with corneal transplantation. I shall refer to the literature on this subject only for comparison of certain facts with my own experience. I shall omit the history, as I think it is already well known. I should like only to draw attention to the fact that the idea of keratoplasty belongs to Reisinger, Riecke, Mosnez and Himly, to von Hippel and Power, who achieved it technically, and to Zirm who in the beginning of the twentieth century was successful with his famous case. It was Elschnig who actually inspired the ophthalmologists with his splendid work to follow the torch of research in the problem of the transplantation with the assurance of its great future success.

I made my first attempts at corneal transplantation in 1912; in 1922 I started to work on the problem systematically, using for information the articles of Elschnig and of his school (Ascher [1]; Stanka [2]; Liebsch [3]).

I performed transplantation of the total cornea, and of part of its layers, and partial penetrating transplantation of the cornea.

I shall describe the first two types briefly and the partial penetrating transplantation in more detail, since I have performed the last operation more frequently and with better success.

TRANSPLANTATION OF THE WHOLE CORNEA

In 1912 and 1915 I performed transplantation of the total cornea on two patients, using the following method: The cornea to be transplanted was cut off with a narrow rim of the sclera and conjunctiva; it was put into the defect in the patient's eye, the conjunctiva of which was undermined beforehand. The conjunctiva was stretched with purse-

---

From the Eye Clinic of the Odessa Medical Institute.

1. Ascher: (*a*) Problem of Keratoplasty, Arch. f. Ophth. **99**:335, 1919; (*b*) **107**:439, 1922; (*c*) **111**:446, 1923.

2. Stanka: Further Information on Keratoplasty, Arch. f. Ophth. **118**:335, 1927.

3. Liebsch: Further Information on Penetrating Corneal Transplantation, Arch. f. Augenh. **103**:603, 1930.

string sutures over the transplant. The result was a thick leukoma with the transplant retaining its shape (Filatov [4a, b]).

Twice I performed transplantation of the total cornea according to the idea of Diffenbach: The cornea to be transplanted, with a rim of the sclera and conjunctiva, was put on the patient's leukoma; the patient's conjunctiva, undermined beforehand, was sutured to the conjunctiva of the transplant. After the transplanted cornea "had taken," the leukoma was resected under the transplant, which was incised at the periphery and turned up. In both cases the transplant became opaque and was absorbed, and the opening in the leukoma was closed with scar tissue (Filatov [5]).

In one case I performed a total autokeratoplasty from the skin of the forehead and eyelid, the conjunctiva and the sclera. After a year the transplant remained slightly transparent, but an attempt at removing the connective tissue membrane which developed behind the transplant resulted in an infection and loss of the eye (Filatov [5]).

Twice I performed transplantation of the total cornea on eyes with staphyloma. The following method was used: I cut out in the staphyloma four triangles with their bases at the limbus. It looked like a grating with narrow bars. Through one of the holes, I drew in the corneal transplant. The cross-bars held it in its place, instead of sutures. The result of that operation was a complete leukoma of good shape (Filatov [6]).

One operation was performed by using the modified Diffenbach method. The cornea to be transplanted was cut off with a rim of sclera and conjunctiva 3 mm. wide; the patient's conjunctival sclera was undermined and stretched with four sutures, and a wide trephine opening was made in the leukoma; the corneal transplant was placed on the leukoma; the transplanted conjunctiva and the patient's conjunctiva were sutured. The result of the operation was the obliteration of the opening with absorption of the transplant (Filatov [7]).

I performed, in one instance, an autokeratoplasty of the anterior part of the eye. The patient had one blind eye as the result of glaucoma and had a total staphyloma in the other eye. From the glaucomatous eye the cornea was excised with a wide strip of the conjunctiva and

---

4. Filatov: (*a*) Concerning Problems of Complete Corneal Transplantation, Vestnik oftal. **30**:534, 1913; (*b*) A case of Complete Corneal Transplantation, Tr. Odessa Oftal. Soc., 1915.

5. Filatov: Materials on the Problem of Complete Corneal Transplantation, Russk. oftal. j. **3**:223, 1924.

6. Filatov: Technique of the Complete Corneal Transplantation, Klin. Monatsbl. f. Augenh. **72**:423, 1924.

7. Filatov: Transplantation of the Cornea, Russk. oftal. j. **3**:717, 1924.

sclera, ciliary body and iris. The staphylomatous eye was treated in the following way:

(*a*) The scleral conjunctiva was widely undermined. (*b*) A continuous crossed suture was drawn through the base of the staphyloma; the starting loop was at the temporal side of the horizontal meridian, and the loose ends of the suture were drawn at the nasal side. (*c*) The staphyloma was cut off in front of the sutures. The lens was removed; the sutures were firmly tightened and tied, a procedure by which the anterior segment of the eye was flattened. There was hardly any loss of vitreous. The transplant was put on the patient's eye, and its scleral edge was sutured with the patient's sclera except at the starting and finishing points, where the sutures were left temporarily untied. (*d*) The starting loop of the suture was cut with forceps and scissors, and it was pulled out on the opposite side. (*e*) The remaining sutures were tied. Because of the removal of the sutures of the staphyloma, the wound was gaping widely under the transplant; there was no escape of vitreous.

The patient obtained vision immediately. Gradually the cornea became cloudy. In two years it was diffusely opaque, but the slightly atrophic iris could be seen through it; the pupil was very narrow and covered with a membrane. Vision was perception of light.

The transplantation of the cornea with the ciliary body and iris was done with the purpose of saving the angle of the anterior chamber and also to avoid glaucoma, which usually is the result of an operation of this type on a staphylomatous eye. My patient suffered from glaucoma only during the first few weeks after the operation. The condition disappeared after two sclerotomies of the transplant. The prolapse of vitreous in total transplantations can also be prevented by slipping a silk disk into the anterior chamber through an incision in the staphyloma. This disk is usually sewed to the limbus by means of a Reverdin needle (Filatov[8]).

Besides the seven cases of transplantation of the total cornea reported by me in the present century, I know of only four more: In two of these cases the operation was performed by Burke[9]; in one it was performed by Elschnig on Ascher's patient (Ascher[1b]), and in one by Key.[10]

There have been six cases of transplantation of the anterior segment of the eye: in five it was done by Schimanovsky[11] and in one by Saveliev.[12] Only in Burke's case did the cornea retain a slight transparency; the patient could see a little until glaucoma developed and the eye became

8. Filatov: About the Technic of a Total Corneal Transplantation, Sovet. vestnik oftal. **2**:217, 1933.

9. Burke: Abstr., Klin. Monatsbl. f. Augenh. **66**:951, 1921.

10. Key: Transplantation of Human Cornea, Arch. f. Ophth. **5**:789, 1931.

11. Schimanovsky: Transplantation of the Cornea, Oftal. vestnik **29**:711, 1913.

12. Saveliev: The Problem of Transplantation of the Anterior Part of the Eye, Russk. oftal. j. **8**:228, 1924.

totally blind. In one operation performed by Schimanovsky the cornea remained transparent in one third of the whole surface for two years. I saw that patient.

A successful transplantation of the total cornea in an eye in which the total cornea is involved in staphyloma requires more experimenting. The most important complication after the operation is glaucoma. For this reason, I continue to perform the operation after the method described, which differs from the method of Schimanovsky in that I do not expose the patient's ciliary body or remove the transplant's ciliary body as he does.

TRANSPLANTATION OF PART OF THE CORNEAL LAYERS

In two cases of leukoma formed after a burn, I performed Löhlein's operation without any success.

Twice I operated on leukoma, using Walker's method, with no success. I shall write later about the modification of this method.

I transplanted corneal epithelium in a case of thermic burn of the eye. I did not wait for the sloughing of the necrotic parts of the conjunctiva of the sclera and of the eyelids; I replaced these parts with mucous membrane from the lip after Denig. The lost corneal epithelium was replaced by epithelium excised with a von Graefe knife from the cornea of an eye enucleated from another patient. The result was very satisfactory in both the conjunctiva and the cornea, in which epithelization occurred rapidly (Filatov[13]).

PARTIAL PENETRATING TRANSPLANTATION

Basic Technic.—In the beginning of my experiments with partial penetrating transplantation of the cornea I followed von Hippel's technic with Elschnig's modifications; but later on I made some changes because, first, the method described did not obviate the possibility of undesirable complications; second, I was trying to make this operation less difficult, so that it would not require so much virtuosity, so to speak, on the part of unskilled surgeons.

1. Preliminary Measures: The skin of the face and eyelids is disinfected with 1 per cent solution of brilliant green. Isolation of the operative field is accomplished. Akinesia is obtained after the method of Van Lint. Epibulbar (5 per cent cocaine) and retrobulbar (1 per cent procaine hydrochloride) anesthesia is used. The conjunctival sac is washed with a solution of brilliant green, 1:2,000; the same solution is used during the operation. The bridle suture is employed on the superior and inferior recti. If the patient is restless, it is necessary to use sutures on all the recti.

13. Filatov: How to Treat Burns of Conjunctiva and Cornea, Russk. oftal. j. **14**:299, 1931.

2. Fixation of the Transplant: I use two methods for fastening the transplanted cornea: I cover it with an egg membrane, with Elschnig's sutures over it, or more often I cover it with a conjunctival flap. In the first case I draw Elschnig's suture through the conjunctiva at the upper edge of the leukoma and pass it with two needles at the lower edge of the leukoma; a similar suture is drawn in the horizontal meridian. In the second method, a flap of the scleral conjunctiva is cut at the upper part of the eye. The beginning of the flap is at the superior rectus; the base is at the limbus, and the flap is 6 mm. wide (fig. 1). Two sutures with double needles are pulled through the lower end of the flap and through the conjunctiva at the limbus. They are temporarily turned up. The upper defect of the conjunctiva is left unsutured.

3. Excision of the Corneal Transplant: The eye is washed with a solution of brilliant green, 1:2,000; it is wrapped in dry gauze and is held firmly with the left hand. The trephining is done with von Hippel's trephine, 4 mm. in diameter. If the disk is not cut on the whole circumference, the cutting may be finished with scissors. The disk is put on the spatula in a Petri dish. Majewsky's method can also be used. The eye is emptied of its contents; the sclera, pressed

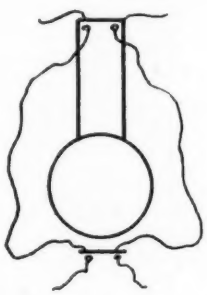

Fig. 1.—The conjunctival flap is made, and the suture threads are passed.

against the posterior surface of the cornea, serves as a supporting base for the trephine.

4. Placing of the Prophylactic Spatula Through the Anterior Chamber: Whenever the trephine is used there is always danger of injuring the lens, with a second complication following—the loss of vitreous. If the lens is absent, the vitreous may prolapse during the cleaning of the posterior surface of the opening made with the trephine from the iris, scar tissue and lens capsule. The prophylactic spatula is used for the prevention of both injury of the lens and loss of vitreous (Filatov[14]; fig. 2 *A* and *B*).

First, two incisions are made by means of von Graefe's knife, as shown in figures 2 and 3, the internal incision being 3 mm. and the external 6 mm. wide. Second, the ivory spatula, 5.5 mm. wide, shape *a* or *b* (fig. 2 *C*) is inserted through the incisions, with sutures pulled through holes at the ends of the spatula (fig. 2 *D*).

5. Trephining the Leukoma: The surgeon is holding the spatula by the suture at one end; his assistant is holding it by the suture at the other end, holding it taut. The trephine, placed on the leukoma, touches it lightly; the spring of the trephine is loosened; the crown of the trephine, with a diameter of 4.05 mm., cuts

14. Filatov: On the Technique of a Partial Penetrating Keratoplasty, Ztschr. f. Augenh. **65:**147, 1928.

the disk of the leukoma down to the spatula. Anterior synechiae in front of the spatula, if present, should be divided. If the leukoma is so dense that the pupil and lens cannot be seen, the spatula might be removed, while the suture is left in the trephine opening. The surgeon then frees the field of the trephining from scar tissue, and removes the capsule of the lens and the lens if it is opaque. I personally extract the lens afterward, if this is necessary. If the disastrous complication—

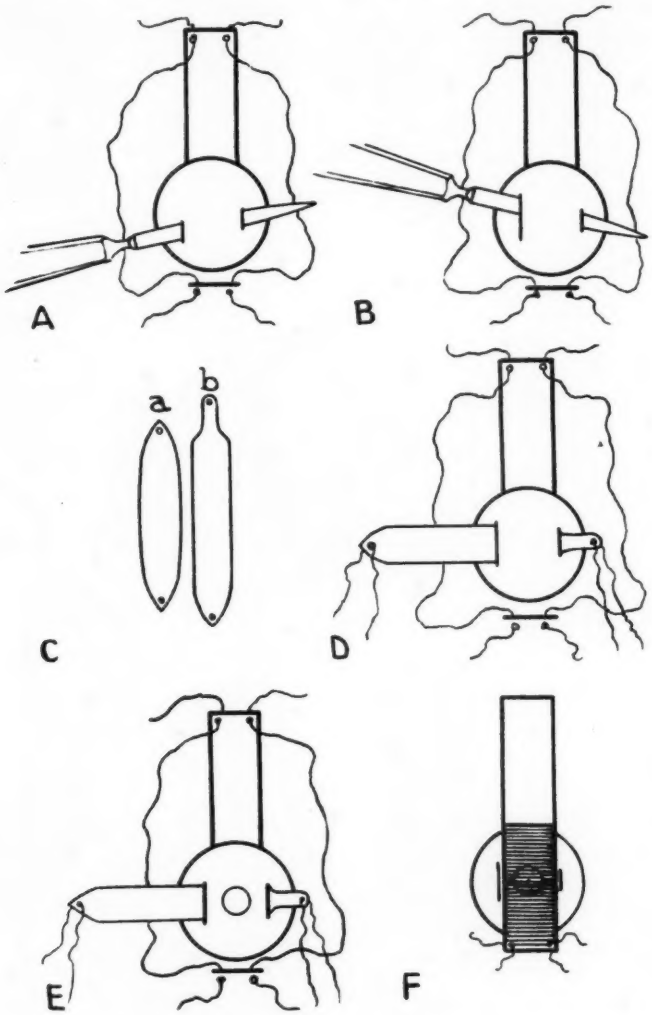

Fig. 2.—*A* and *B* show the incisions of the leukoma made with von Graefe's knife; *C*, the spatula shaped as in *a* or as in *b*; *D*, the insertion of the spatula into the anterior chamber; *E*, the transplant placed in the trephine hole of the leukoma; *F*, the transplant covered with the conjunctival flap and the spatula removed.

the prolapse of the vitreous—occurs, the spatula should be inserted again into the anterior chamber in order to stop the prolapse.

6. Placing the Transplant and Its Fixation: The transplant is placed in the opening, which is closed posteriorly by the spatula. The sutures should be taken off the spatula, so that they will not be in the way. Since the opening in the

leukoma is 0.05 mm. wider than the transplant, the latter is easily placed in the defect. The wound is sponged carefully. The conjunctival flap with its epithelial surface is stretched over the transplant. The sutures are tied with three plain knots. In case it is impossible to use the conjunctival flap because of scar tissue changes, a small round piece of a boiled egg's membrane with its inner surface is used instead. Radial incisions are made on its surface for better fitting. Elschnig's crossed sutures are drawn over it and are tied (Filatov[15] fig. 2 *E* and *F*). The egg membrane or the conjunctival flap can be applied without using the spatula. Elschnig's sutures over the egg membrane do not irritate the epithelium as much as when they are put directly over it. The conjunctival flap irritates the epithelium still less. The comparative value of various methods of fixation of the transplant were tried experimentally by Filatov, Velter and Oradovskaya.[16] The use of the celluloid cover is not recommended.

7. Removal of the Spatula: After the transplant is placed and covered well, the spatula is removed from the anterior chamber by its external end with a sure quick movement. If the vitreous appears in the wound, it is cut off; the same is done with the iris. The bridle sutures are removed. Atropine and a binocular dressing are applied.

Other Methods Used.—The other methods used by me concern mostly the trephining of the graft and of the leukoma.

1. For transplantation I excise a piece of cornea with von Graefe's knife and scissors in the shape of a trapezium. The graft is placed on the patient's leukoma, and its outlines are marked on the leukoma by von Graefe's knife. The graft is then removed; the leukoma is excised according to the outlined shape, first by the knife, then by forceps and scissors. The conjunctival flap is placed over it.

2. I perform the trephining with a hand-trephine of the Bowman-Elliot type, which has a wide crown. I use the safeguarding spatula at the same time.

3. I excise the leukoma with Holth's instrument, making a preliminary incision with a keratome. The transplant is cut with the same instrument, so that it fits perfectly into the defect.

4. I invented a combination of a hand-trephine with a safeguarding spatula (trephine of Filatov and Marzinkowsky). It is constructed as shown in figure 3. The handle of this instrument ends with a guiding groove into which the trephine is inserted; the latter with its cutting crown rests on the ivory spatula, which is fixed on the handle with a screw. The narrow end of the spatula has a hole for a suture. The technic of using it is simple. After the conjunctival flap has been prepared, the incisions are made in the leukoma with von Graefe's knife.[17] Through

15. Filatov: How to Place the Transplanted Cornea Securely, Russk. oftal. j. **10**:676, 1928. Filatoff.[14]

16. Filatov, Velter and Oradovskaya: Organization of Transplantation of the Cornea, Vrach. delo **22**:715, 1933.

17. Both incisions are of the same width (6 mm.) in order that the crown of the trephine may fit into that space of the leukoma which is designed for trephining. It is convenient to make the incisions with a knife shaped like a spatula, 6 mm. wide, with parallel blunt edges and with a sharp point (like a keratome). The knife is at an angle to the handle. In shape, it resembles Castroviejo's (Keratoplasty, Am. J. Ophth. **15**:825, 1933) and Nižetic's (Eine Modifizierung der Technik bei der totalen durchgreifenden Keratoplastik nach Filatow, Klin. Monatsbl. f. Augenh. **93**:89, 1934) knife, also the knife which I described (Filatov: A New Trephine for Partial Penetrating Corneal Transplantation, Sovet. vestnik oftal. **4**:215, 1934).

the incisions the spatula is inserted. The suture is drawn through the hole in the spatula. The surgeon holds the handle with his left hand while the assistant pulls the suture slightly. With the right hand the surgeon inserts the trephine into the groove, presses it toward the leukoma, and rotates the trephine back and forth until it touches the spatula. The trephine is lifted in order to see whether the disk is excised completely; if not, the trephine is lowered again until the disk is cut. After removal of the disk, the handle is unscrewed and removed while the spatula is left in the anterior chamber. The suture is removed; the transplant is placed in the opening and is covered with the conjunctival flap; after this the spatula is removed.

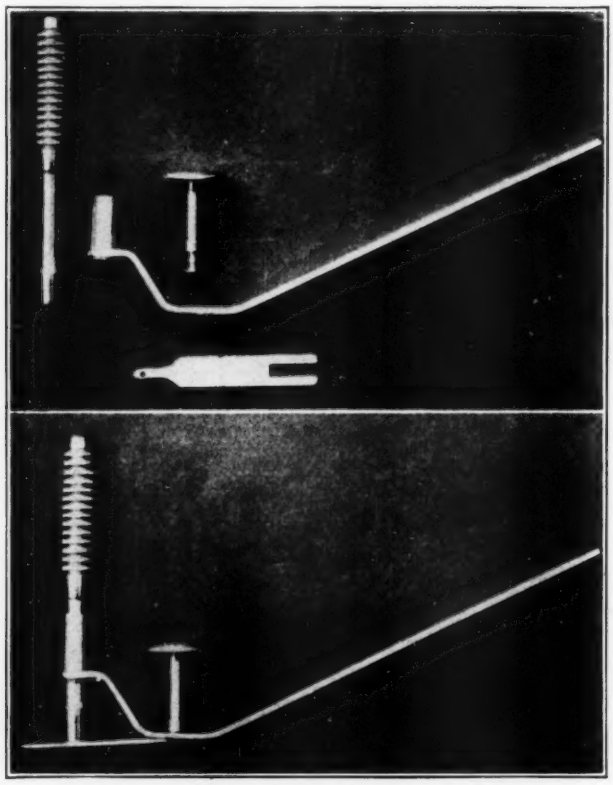

Fig. 3.—The Filatov-Marzinkowsky trephine: *A*, separate parts of the trephine; *B*, the trephine complete.

Complications During Operation.—1. Injury of the Lens: If an injury of the lens occurs during the operation without the safeguarding spatula, it can be diagnosed easily. It is essential to extract the lens and to try to avoid the escape of vitreous. If the spatula is used, an injury of the lens may happen when the knife is slipped behind the leukoma. An injury of the lens may also occur (seldom in my own experience) if the anterior chamber is absent. It is traced easily by removing the spatula, as I have explained.

2. Escape of Vitreous: This complication is very dangerous. It may be of two kinds: In some cases the vitreous is thick. In some, it is liquefied, which can be explained as follows: The shrunken vitreous covers the eyeground with a thin layer, and the escaping liquid is aqueous which fills the space free from vitreous.

If the escape of vitreous cannot be stopped, the eye may become atrophic. The escape also endangers the successful result of the transplantation. If the vitreous is very thick and the plate is not used it is very hard to put the transplant into the opening, because the vitreous pushes the transplant out. If the vitreous is liquefied, the eye easily shrinks, the air gets into the eyeball, and the transplant may recede. In these cases the transplant is sutured to the edge of the opening with two or three sutures. However, this procedure dooms the transplant to opacification.

This complication forced me to invent the safeguarding spatula, which either prevents the escape of vitreous or stops it, if it occurs.

In case the operation is performed without the spatula and the escape of vitreous has started, I propose two methods for stopping it:

(*a*) If the vitreous is liquefied I put two or three stitches through the leukoma at one edge of the opening and pass them behind the opening to the other edge. These stitches are joined so that they form a net which holds the transplant in its place and does not allow the moving of the transplant back or forth. The technic of tightening these stitches is difficult, as it is important not to change the round shape of the opening.

(*b*) If the escaping vitreous is thick, two incisions should be made on each side of the leukoma, each 6 mm. long, with von Graefe's knife. The spatula, 5.5 mm. wide, is inserted into the anterior chamber. After this the transplant can be placed and covered with the conjunctival strip, which is drawn taut over it.[18]

3. Expulsive Hemorrhage: In this complication Verhoeff's method, which was introduced by him in 1915, should be used. I used the same method independently of the article by Dr. Verhoeff (whose priority I indeed emphasize), as I thought that in some cases of this type the establishment of a side channel for the outflow of the blood from the

18. For stopping the prolapse of the vitreous, I recently suggested an instrument which can be called a "disciform retrograde obturator." It consists of a stem to the end of which is attached perpendicularly a disk 5 mm. in diameter. If the vitreous begins to prolapse, the disk is passed through the trephine hole into the anterior chamber; the stem is held obliquely, and it is put back into perpendicular position as soon as the disk is in the anterior chamber, so that the disk covers the opening tightly. Then the incisions are made in the leukoma, and the spatula is passed into the anterior chamber. The stem is bent again and the disk is removed. The transplant is put in place and covered with the conjunctival flap. It is desirable to have a few various-sized obturators (5, 5.5 and 6 mm.), because the edges of the trephine opening may stretch to various degrees (Filatov: Material on Corneal Transplantation, J. M. Ukranian Acad. Sc. **3**:296, 1933).

suprachoroidal space through an opening in the sclera might save the eye. I make an opening in the lower temporal quadrant of the sclera with Elliot's trephine (3 mm. in diameter). I succeeded in saving four eyes in expulsive hemorrhage, and in one eye even vision was preserved (Verhoeff,[19] Filatov [20]).

Postoperative Care.—The procedures in postoperative care are as follows: 1. Elschnig's stitches and the egg membrane should be taken off in two days. 2. The strip of conjunctiva should be removed two days later. 3. Atropine should be used daily.

Postoperative Complications.—1. Slipping off of the Transplant: This complication I observed only twice in more than one hundred operations. In one case I put the transplant back; it united but became opaque later. In another case the conjunctival strip came off because the stitches cut through the tissue and the vitreous pushed the transplant out. I inserted the spatula through the unhealed incisions and put in the defect a new graft, which was held in place by the egg membrane and Elschnig's stitches. If the transplant is edematous and does not fit in the opening, and another transplant cannot be obtained immediately, the opening should be covered by Kuhnt's method (a piece of fascia lata is inserted instead).

2. Escape of Vitreous from Trephine Opening: This requires either the method which I have already described or the stitching of a piece of fascia lata to the edge of the opening and fixation of it after the method of Kuhnt.

3. Fistula: Fistula near the edge of the opening requires thermocautery with covering according to the method of Kuhnt.

4. Synechiae: The formation of anterior synechiae, which may lead to glaucoma, requires iridectomy.

Material for Transplantation.—1. Eyes of Living Human Beings: I use the transparent cornea of eyes enucleated because of serious ailments, such as absolute glaucoma with severe pain, trauma, atrophy of various origins and conditions requiring exenteration of the orbit. I have never risked using eyes affected with purulent iridochoroiditis or with intra-ocular sarcoma.

2. Autoplastic Material: When using the cornea of a blind eye of the same patient, I do not enucleate the eye, but excise a piece of cornea for the transplantation and close the opening by Kuhnt's method. If the first transplantation is not successful, I can use another piece of

19. Verhoeff: Scleral Punctures for Expulsive Hemorrhage, Ophth. Rec. **24**: 55, 1915.

20. Filatov: Surgical Treatment of Expulsive Hemorrhage, Arch. de oftal. hispano-am., June 1934, p. 1; Sovet. vestnik oftal. **3**::3, 1933.

the same cornea for the second operation. My impression is that autoplastic is better than homoplastic material.

3. Material from Cadavers: Since the amount of cornea required for patients with leukoma is greater than the amount available for transplantation, I have experimented with the cadaver's cornea and with the conservation of the cadaver's eyes.[21] I have used the eyes of prematurely born babies, but with poor results; with eyes of adults I have had better success. The eyes were enucleated within from two to three hours before the body was taken into the morgue or while in the morgue, i. e., within a few hours after the person died. The cornea was used for operation either right away or, more often, it was kept in the ice chest at a temperature of 4 C., and it was used within from twenty to fifty-six hours after death.

I can say with perfect assurance that corneas taken from the eyes of cadavers, even those which had been conserved for a long time, proved to be just as good as those taken from living persons, within the period of from three to four months of observation. I have observed only one case over a longer period, a very valuable one. A transplant taken from the eye of a cadaver forty-one hours after death kept a fairly good transparency for thirteen months after the operation.[21a] The obtaining of cadavers' eyes and their preservation have not been satisfactory under present conditions as the required temperature of 4 C. cannot be maintained until the eyes are delivered to the clinic. After eyes have been obtained from a cadaver they are washed in brilliant green solution, 1:2,000, and put with the corneas upward in a glass jar with a tightly fitting cork. I have also tried to keep them in citrated blood from the person from whom they were obtained, according to Professor Judin's advice. My observations confirm those of Magitot,[22] who in one of his operations succeeded in obtaining a transparent taking of a cornea removed from the eye of a cadaver, preserved in

21. Filatov: The Cadaver's Cornea for Corneal Transplantation, Sovet. vestnik oftal. **4**:221, 1934.

21a. In fourteen months an extraction of the lens was done on the eye previously operated on, with unfavorable results. In the second case of a leukoma in parenchymatous keratitis the transplant, taken from a cadaver's cornea (which was conserved at 6 C. for twenty-one hours), was transparent for a period of nine months, and vision was 1/10. Later on the glaucoma which was observed previous to the transplantation took a serious course, and repeated attacks compelled me to perform three antiglaucomatous operations, which gave no improvement. In fifteen and one-half months after the transplantation the transplant was transparent to such a degree that the iris was still seen, and the vision was from 1/20 to 1/60. The thirty-five transplantations from cadavers' corneas belong to the second series (about seventy-five operations), which I have not yet worked up.

22. Magitot, A.: Preservation of the Cornea; General Review, Arch. d'ophth. **32**:68, 1912.

hemolized blood of the cadaver and kept for eight days at a temperature of 4 C. Magitot was also successful in using the cornea of an embryo.

Thus I may say that the using of transplants from cadavers' eyes has a good prospect of success. This is analogous to the problem of blood transfusion from dead bodies, which was taken up by Shamov experimentally, and which gave splendid results in the work of Judin (Moscow).

4. Conditions Required on the Part of the Donor of the Eyes: The person, living or dead, whose eye is used, must not have any general infection, particularly syphilis. The homogeneity of the donor's and the patient's grouping of blood is of no importance. In one of my most successful cases the blood of donor and patient showed a different grouping.

Indications and Contraindications for Operation on the Patient's Eye and an Anatomicosurgical Qualification of the Leukoma.—1. If the patient has no perception of light, the transplantation of the cornea is done only for cosmetic purposes. Faulty projection of light is not always a contraindication to the operation.

In a few such cases the operation gave the patient back some vision in that postoperative period during which the cornea was transparent. In case 2 the operation was at first refused because of faulty projection of light, but later the transplantation was performed, and vision was improved permanently to 1/100. Faulty projection of light, which is met with rather frequently in eyes having leukoma from early childhood, gives grounds for refusing the operation because of an evident pathologic condition of the eye (glaucoma, subatrophy, etc.).

2. The operation is contraindicated in cases of glaucoma particularly with buphthalmos, if the tension has not been relieved by a preliminary operation. While experimenting with the problem of transplantation I have often performed partial penetrating corneal transplantation on eyes with the described unfavorable conditions. Of ninety-six operations in the first series of cases included in my material, forty-eight were performed in thirty-eight cases of such pathologic ocular conditions. There was not a single successful taking of the transplant. This confirms Elschnig's observations. Eyes affected with such conditions should not be operated on or they should be excluded from the general statistics of the results of transplantation. It is much better to do a preliminary operation on an eye thus involved before the transplantation, in order to improve the general condition of the eye and of the leukoma. I will write about it later.

3. A partial staphyloma makes the condition for the operation unfavorable, if it cannot be removed by trephining at the time when the transplantation takes place. The same statement can be made as to ectatic leukoma.

4. A fistula, even if it is repaired by transplantation, is usually followed by glaucoma after the operation.

Indications for the Operation in the Histologic Nature of the Eye on Which Transplantation Is Performed.—The conditions described have no direct bearing on the problem of transplantation or have only some technical influence on the result of the operation, but the histologic nature of the leukoma, even if the enumerated conditions are absent, is the main factor which influences principally the fate of the transplanted cornea. Elschnig deserves all the credit, as he proved by observation that leukomas are of two types: one in which no corneal elements are left, and one in which they are present. The second group always gives a better prognosis for transplantation than the first.

1. Total Cicatricial Leukoma: To this group belong leukomas of the type which forms after ulcer of the cornea. Very few successful transplantations have been done on leukomas of this type. In twenty-two operations on rough cicatrices I had only one which was followed by permanent transparent taking of the transplant, and even in that case there were some corneal elements present. Since the transplantation in cases of this type is almost hopeless the question arises whether it should be performed at all. Still one must not forget that there are a few cases of the so-called semitransparent taking of the transplant which improves the vision to a certain extent (to perception of hand movement or the counting of fingers at a distance of 1 meter). Even when the transplant is opaque, it seems to me that the patients get a definite improvement in perception of light which they value very much. Elschnig noted a semitransparent taking of the transplant in 40 per cent of these cases. I had improvement in seven of twenty-two cases; i. e., in 33 per cent the vision improved—in two cases to 1/180, in three to 1/120 and in two to 1/60.

2. Leukomas with Presence of Some Transparent Corneal Tissue: They may be divided into several groups: (*a*) cicatricial leukoma after ulcer which occupies the whole cornea with some layers of the corneal elements present; (*b*) cicatricial leukoma of the central part of the cornea, with preservation of some transparent sectors on the periphery, not sufficient for getting good results from iridectomy; also leukoma with semitransparent sectors on the periphery only; (*c*) cicatricial superficial leukoma, after a burn, trachomatous pannus, herpetic keratitis, etc.; (*d*) deep permanent opacity after parenchymatous keratitis.

All these types of leukoma present the most favorable field for transplantation. Elschnig proved that in cicatricial leukoma the transplant must be placed in such a way that its edges would be in contact with that part which contains the corneal elements; for this purpose it sometimes has to be placed eccentrically. In the third group a layer trans-

plantation could be done, but it seems better to follow Elschnig's method and to perform a penetrating transplantation. Elschnig reported 73 per cent successful operations on leukomas of the fourth group (parenchymatous keratitis). I, personally, having summed up all my cases in which some of the corneal tissue was present, twenty-six in number, had thirteen in which there was permanent transparent taking of the transplant. If I add the case described in a foregoing paragraph the number will be fourteen, which makes 54 per cent. In parenchymatous keratitis I had 66 per cent successful results.

The enumerated groups are not always good for transplantation, as some may have heavy vascularization (parenchymatous keratitis) or too dense an opacity in the form of the so-called "albugo." In such cases the porcelain white leukoma joins at the limbus, without a transitional margin, the infiltrated white sclera, which in the periphery is slate-colored, owing to scleritis. It is indeed very important to improve the general condition of the patient regarding syphilis. If in the compilation of statistics one excludes the operations which were performed with gross technical mistakes or under some unfavorable conditions such as symblepharon, the cases in which there was permanent success might be increased to 70 or 75 per cent.

Preliminary Operative and Nonoperative Preparations Before Transplantation of the Cornea.—A number of unfavorable conditions weigh on the prognosis of corneal transplantation, and preliminary measures to clear them away are required before the operation:

1. The operative field must be improved regarding infection, which means treatment of such involvement as blepharitis and conjunctivitis and the removal of infected lacrimal sacs, etc.

2. Symblepharon requires a plastic operation with the use of the mucous membrane of the lip.

3. Syphilis (parenchymatous keratitis) should be treated very carefully. In one of my successful transplantations the end-result was poor because of the recurrence of the syphilitic process.

4. Glaucoma requires an operation, but often the combination of leukoma and glaucoma makes the usual operative intervention inadequate. Taking this into consideration, I have worked on a new principle for the filtrating operations.[23] The main idea in my methods is to aid the formation of the fistula by using Descemet's membrane, a strip of the cornea or the lens capsule. Here are some of the methods:

(*a*) The scleral conjunctiva is separated to the limbus as in Elliot's operation. Then an incision or trephining of the limbus is made, with the insertion of a lens capsule taken from a dead body into the opening. The flap is put in its place.

23. Filatov: Search for a New Principle for Securing Filtration in Glaucoma, Sovet. vestnik oftal. **4**:215, 1934.

(*b*) The same conjunctival flap as in *a* is used. Two incisions are made with a linear knife at the posterior margin of the limbus. A forceps is inserted through them with a semicircular piece of Descemet's membrane taken from the patient's eye with a thin layer of the cornea. The flap is put in place.

(*c*) The conjunctival flap is undermined to the limbus. The cornea is split into layers so that when the flap is turned up most of the corneal surface is exposed. A section is made with a keratome at the external margin of the limbus. At one end of the section a small radial incision is made toward the center of the cornea. From this end another parallel incision is made with scissors. The corneal strip thus obtained is pulled up by a suture toward the sclera. The sutures are pulled through the edge of the conjunctival incision and tied. The conjunctival flap is put into place.

(*d*) A vertical incision is made along one third of the diameter of the cornea. The central edge of that section is undermined sufficiently for pulling through it three loop stitches to the circumference of the cornea, around which the scleral conjunctiva has been separated beforehand; the stitches are pulled through it, and when they are being tied the conjunctiva is pulled into the incision. Two weeks after the conjunctiva has united with the cornea, a conjunctival flap is made and turned up. A strip is cut off the cornea which was covered with the flap, as described in method 3, or Elliot's trephining is performed. The flap is put back in its place.

The first three methods gave me good results in several cases, but I have not observed the results sufficiently long. The fourth method is still in the experimental stage.

5. The posterior surface of the cornea must be cleaned of anterior synechiae. If the leukoma is semitransparent and the anterior synechiae can be seen through it, or if they can be seen through some transparent parts of a dense leukoma, it is desirable to remove the synechiae by one or several operations and to free the field as much as possible from the iris for the future transplantation. Elschnig was quite right in pointing out that anterior synechiae are harmful to the transparency of the transplant.

6. If the leukoma is so thick that it is impossible to examine the anterior chamber, and if the eye appears to have not only synechiae but also scar tissue, it is useful to clean the whole posterior surface of the cornea by *exenteratio retrocornealis anterior partialis:*

(*a*) Two stitches are made after the manner of Liegar.

(*b*) A section is made along the limbus on two thirds of its circumference.

(*c*) The flap is turned up and is cleaned from the synechiae.

(*d*) The scar tissue is cut with von Graefe's knife and, without being pulled with forceps, is cut off with scissors so as not to injure the ciliary body. The vitreous usually escapes quite freely.

(*e*) The flap is put in its place, and the stitches are tied. If the eyeball collapses, an injection of physiologic solution of sodium chloride is made. There is

a certain risk in this operation, of course, but if the eye stands it well, there are chances for successful transplantation (Filatov [24]).

Amelioration of the Leukoma.—Elschnig made a most valuable observation, namely, that the transparent corneal elements act favorably on the transplant. He did not analyze this observation theoretically, but he made two practical deductions. He pointed out that it is necessary to place the transplant next to that part of the leukoma which has retained some corneal tissue. He also conceived the idea of performing, in cases of staphyloma, total corneal transplantation, thinking that if total transplantation was unsuccessful optically, the transplant, even if it became opaque, would make a better field for a subsequent partial penetrating transplantation. Elschnig's idea concerning cases of staphyloma has not been tried practically by any one, but it gave me the idea of improving the field for operation in the rough cicatricial leukomas.

1. Homoplastic Method: Even when leukoma develops because of a large, deep ulcer, there are many chances that the posterior layers in a very small part of the cornea are still preserved, though at times they may be only semitransparent. This thin layer of the corneal elements is not sufficient to produce a favorable soil for the transplant, and will eventually be surrounded by the cicatricial tissue. But if the leukoma is excised, layer by layer, almost to the very posterior ones, on a large surface, and the wound is covered with the corneal layers of another eye, there are more chances for its favorable growth. The purpose of such an operation is not to restore vision, but to create a better field for the next partial penetrating transplantation. I have performed such amelioration of the leukoma many times, and I am convinced that the layers of cornea take well, as in these instances they kept their transparency during the period of observation (from two to three months). Several times I have performed a penetrating transplantation on such eyes. In two of three cases the cornea kept its transparency during the period of observation, which was several weeks.

The technic of amelioration of the leukoma which I offer is as follows:

(*a*) The leukoma is excised with von Graefe's knife until the posterior layers appear.

(b) Corneal layers are placed (a few pieces) on the exposed surface.

(*c*) They are covered by a strip of the conjunctiva, which is prepared beforehand in the manner already described. It is interesting that the amelioration itself sometimes improves the vision to perception of hand movements.

---

24. Filatov: (*a*) Concerning the Problem of a Corneal Transplantation, Ukrainian Ophth. J. **1**:27, 1929; (*b*) Some New Ideas on Corneal Transplantation, Arch. f. Augenh. **107**:153, 1933.

2. Amelioration by Autoplastic Transplantation: Sometimes it is possible to use the corneal layers of a blind eye of the patient. In one case I obtained the amelioration in such a way: I cut off the anterior layers of the centrally located leukoma and placed on the wound corneal layers taken from the peripheral semitransparent part of the same eye. The problem of amelioration requires some further investigation.

Process of Healing of the Transplant.—Elschnig noticed in the healing of the transplant three periods of opacification. According to my observations, the opacity which immediately follows the operation passes after several days or at least lessens. The second period of opacity, according to Elschnig, is the period of reaction of the surrounding tissue to the degeneration of the transplant. This opacity lasts for various lengths of time; it clears or grows denser at times. It appears in the form of exfoliation of the epithelium, blebs, infiltration and growth of blood vessels. I have not observed the late opacity of what Elschnig calls the third period.

There is no sufficiently clear conception about the pathogenesis of the opacity of the transplant, the lasting process of which is so tragic for both the patient and the surgeon. Whether a low grade infection takes place in these cases is hard to tell. One of the most annoying complications in the postoperative period is the development of a connective tissue membrane on the posterior surface of the transplant. Sometimes a transplant which took perfectly is useless for restoration of vision because of this scar tissue. It seems to me that it forms more readily the more there are anterior synechiae. At the present time it is not known how to control this sad complication.

In regard to the length of the period of the transplant's fight for its transparency, I think that a period of twelve months is quite sufficient to insure permanence, and Elschnig considers that transparency maintained for twelve months is permanent. Before, Elschnig considered nine months a sufficient period of observation.

Treatment of Opacity of the Transplant: Many attempts have been made to cure opacity of the transplant. I have tried everything that was advised in the literature: atropine, heat, paracentesis, ultraviolet rays, roentgen therapy and autohemodiathermy according to the advice of Professor Aschoff (to whom I had the honor of demonstrating the results in my patients). I found nothing particularly helpful. I tried, after Carrel and Gabschewiez,[25] an eyebath made of chicken's embryonic juice, and found that it had a favorable effect on the epithelium.[26] At

25. Gabschewiez: The Use of Embryonal Extract, Klin. oczna. **3**:1, 1928.

26. I recently found that intravenous injections of 10 cc. of hypertonic solution of sodium chloride (10 per cent) act favorably on fresh opacities of the transplant.

last I tried to apply Fisher's [27] theory of desmons. For that purpose, if the transplant became opaque, I cut off some of the leukomatous tissue and transplanted beside the opacified transplant a few layers of corneal tissue. I took into consideration the hypothesis that fresh corneal tissue might stimulate the nourishment of the transplanted cornea. So far I have not had convincing data concerning this problem.[27a]

Histopathology.—Little is known of the histopathologic developments in corneal transplantation because only three cases have been reported in the literature in which partial penetrating transplantation was studied histologically; these were reported by Fuchs,[28] Frieberg [29] and Ascher. Only in the case of Fuchs did the transplant retain its transparency. In his case the epithelium, Bowman's membrane and the parenchyma of the transplant were normal in three fourths of their thickness; in the posterior layers there was infiltration; Descemet's membrane was wrinkled, with no endothelium and with some layers of new lamellar tissue.

I can add to these cases my own in which the transplanted cornea retained its transparency during three years, till the patient's death. The transplantation was done on a leukoma that formed after parenchymatous keratitis. During recurrences of the keratoscleritis (syphilitic) the transplant lost its transparency, which I explained by changes in the vitreous and fundus. Histologic examination showed that there was a lesion in the macular region. Examination of the cornea disclosed the following facts:

The epithelium of the patient from the edge of the cornea to the border of the transplant showed no pathologic changes; it was normal also over the border, but nearer to the center of the transplant the layers of epithelium gradually became fewer, and in the very center of the transplant the epithelial cover consisted only of from three to four layers of cells (fig. 4 *a*). The basal layer consisted, not of columnar, but of cuboidal cells, some of which had shrunken pyknotic nuclei.

Bowman's membrane of the patient's cornea was indistinct on the whole length of the leukoma except in a few places. From the margin of the union of the transplant with the leukoma, Bowman's membrane was seen clearly along the whole diameter of the transplant (fig. 4 *b*).

The membrana propria of the patient, from the limbus to the margin of the transplant, was markedly infiltrated in its anterior layers directly under the epithelium (fig. 5 *a*). The infiltration diminished toward the posterior surface, and it had the appearance of small circumscribed foci, chiefly in the form of streaks

27. Fisher: Die Gewebezüchtung, Munich, Müller & Steinicke, 1927.

27a. I can confirm, however, from experience with four of my own cases Fuchs' and Elschnig's statement that a considerable clearing of the leukoma surrounding the transplant may occur at times several months after a partial penetrating transplantation.

28. Fuchs: Zur Keratoplastik, Ztschr. f. Augenh. **5**:1, 1901.

29. Frieberg: Optical Keratoplasty, Acta ophth. **5**:122, 1927.

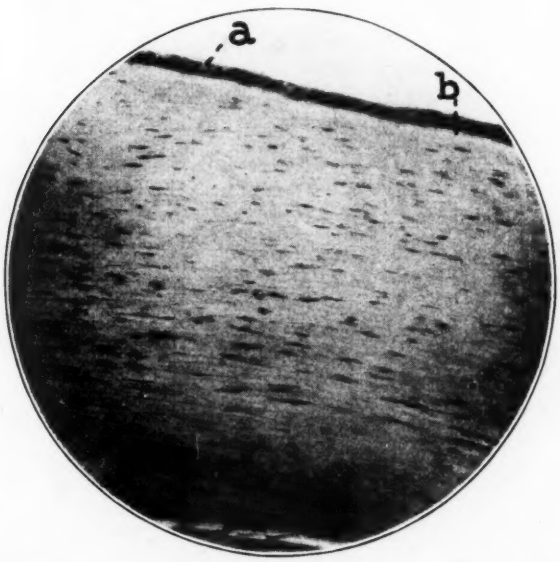

Fig. 4.—The center of the transplant, showing (*a*) an epithelial covering consisting of from three to four layers of cells and (*b*) Bowman's membrane.

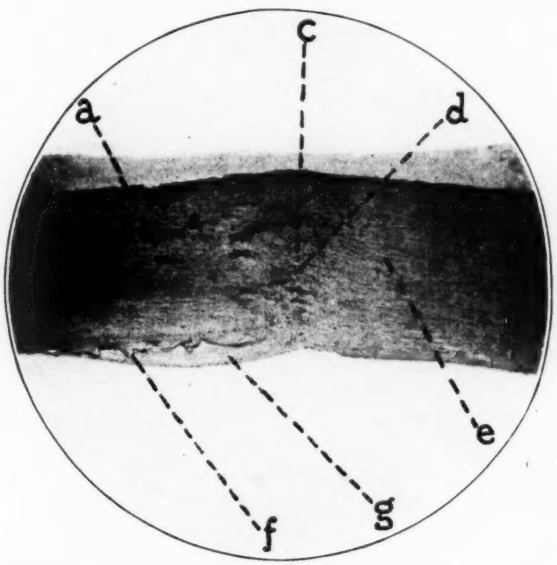

Fig. 5.—Junction of the patient's cornea with the transplanted cornea: (*a*) marked infiltrations in the anterior layers of the patient's membrana propria; (*b*) small, circumscribed foci of diminishing infiltration in the posterior layers; (*c*) irregular arrangement of the tissue; (*d*) remnants of infiltration and of blood vessels in the cicatricial membrana propria at the transition of the leukoma into the membrana; (*e*) appearance of corneal lamellae, which at a short distance from the scar acquire the arrangement of normal cornea; (*f*) folds of Descemet's membrane; (*g*) fibrous tissue covering Descemet's membrane of the leukoma and transplant.

(fig. 5 *b*). In the latter a number of blood vessels were seen in the superficial and in the deep layers. Near the margin of the transplant and the leukoma, the layers of the latter appeared irregular from the epithelium to Descemet's membrane (fig. 5 *c*). A great number of elongated cells of the connective tissue type could be seen with the corneal cells. At the transition of the leukoma into the transplant the membrana propria became visibly cicatricial, with remnants of infiltration and of blood vessels, mostly in the anterior layers (fig. 5 *d*). The beginning of the transplant could be traced by the appearance of the corneal lamellae, which at a short distance from the scar acquired the arrangement of a normal cornea and preserved it along the entire transplant to its opposite side (fig. 5 *e*). An infiltration much less marked than in the leukoma could be seen in the transplant and was observed for the most part along the few blood vessels, which were located chiefly in the posterior layers of the transplant.

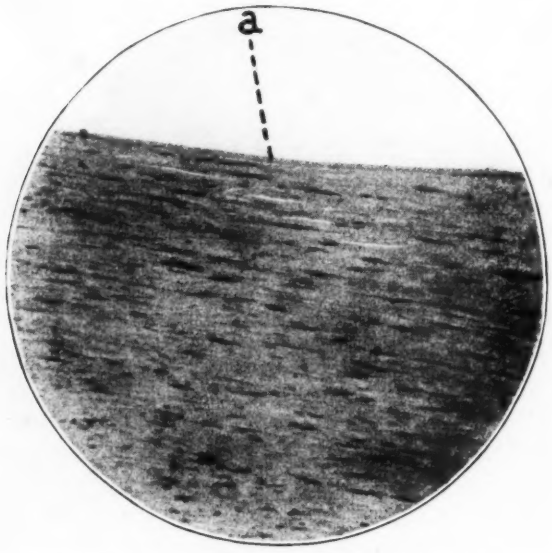

Fig. 6.—Descemet's membrane of the transplant, indicated at *a*.

Descemet's membrane in the patient was well marked to the very margin, where it lay in folds, which at the beginning only might have been an artefact (fig. 5 *f*). The membrane ended at the margin of the cicatrix, to which it was adherent; it was absent in the cicatrix itself. Descemet's membrane of the transplant started directly beyond the cicatrix and was set well (fig. 6 *a*).

Descemet's membrane in the patient was covered all over with fibrous tissue, which was thickest at the angle of the anterior chamber. In the region of the cicatrix the fibrous tissue went over Descemet's membrane of the transplant, but it ended there very shortly and filled the space between the ends of the two Descemet's membranes (fig. 5 *g*). This fibrous tissue had the character of connective tissue, with a small amount of cells and occasional blood vessels. Neither the patient's nor the transplant's Descemet's membrane had endothelium.

At one end of the patient's cornea, the iris was adherent to the posterior surface of the cornea, and because of that on many sections the angle was absent. The iris was very atrophic, and at the side of the adhesion it was not only thinned out but had a coarsely fibrous structure. In some places between the iris and the

cornea there was a layer of fibrous tissue which contained clumps and strips of pigment. There was considerable infiltration at the root of the iris. The ciliary body as well as the ciliary processes were somewhat infiltrated. Epithelium devoid of pigment in the region of the ora serrata showed vacuolation in a few places. The angle of the anterior chamber was well shown on one side, but was slightly infiltrated. On the other side it was absent because of the apposition of the iris to the posterior surface of the limbus. At the margin of the iris and limbus, there was considerable infiltration. The sclera at the limbus was very thin and infiltrated and contained a number of newly formed blood vessels. The subconjunctival tissue near the limbus was heavily infiltrated. The uveal tract and the retina showed no pathologic changes anteriorly. In the posterior part of the fundus, in the region of the macula lutea, a large yellowish-gray lesion was observed macroscopically; the diameter of it was 1.5 mm.; it was situated in the inner membranes of the eye, slightly protruding into the vitreous but not affecting the sclera. The posterior segment of the eye, as well as the lesion mentioned, were not examined microscopically.

General Pathologic Considerations.—Does the permanent transparency of the transplant signify that an actual union has taken place, or does a substitution of the transplanted cornea by the regenerated corneal elements of the host occur? This question is of great pathologic interest and cannot be answered decisively at present. I am of the same opinion as Fuchs and Elschnig, namely, that the transparent taking of a transplant is a true transplantation. This opinion I base on the fact that the well preserved transplant is separated from the tissue of the patient by a fibrous ring; Bowman's and Descemet's membranes undoubtedly belong to the transplant.

CASES IN WHICH PARTIAL PENETRATING TRANSPLANTATION WAS SUCCESSFULLY PERFORMED IN THE EYE CLINIC OF THE ODESSA MEDICAL INSTITUTE

CASE 1 (B. Grusha).—The patient had a complete leukoma, which developed after recurring scrofulous keratitis, and in which were retained small areas of semitransparent corneal tissue. Vision before the operation was equivalent to perception of light. Operation was performed by von Hippel's method. Vision after the operation was 3/60; it had not changed at the time of the patient's death six years later (Filatov[30]; fig. 7 *A*).

CASE 2 (Tkachenko).—A total slightly ectatic leukoma developed after blennorrhea. The first transplantation gave an opaque taking. After the second operation (the material was taken autoplastically from the left eye of the patient) the transplant was fairly transparent; vision before the operation was perception of light; after the operation, 1/60. The period of observation was one year. Within two years the patient had written that the vision was still the same (Filatov[31]; fig. 7 *B*).

30. Filatov: A Case of a Successful Partial Penetrating Transplantation, Klin. Monatsbl. f. Augenh. **74**:746, 1925; Appendix (to foregoing article), ibid. **78**:247, 1927. Filatov.[7]

31. Filatov: A Case of Autotransplantation of the Cornea, Russk. oftal. j. 6:1023, 1927.

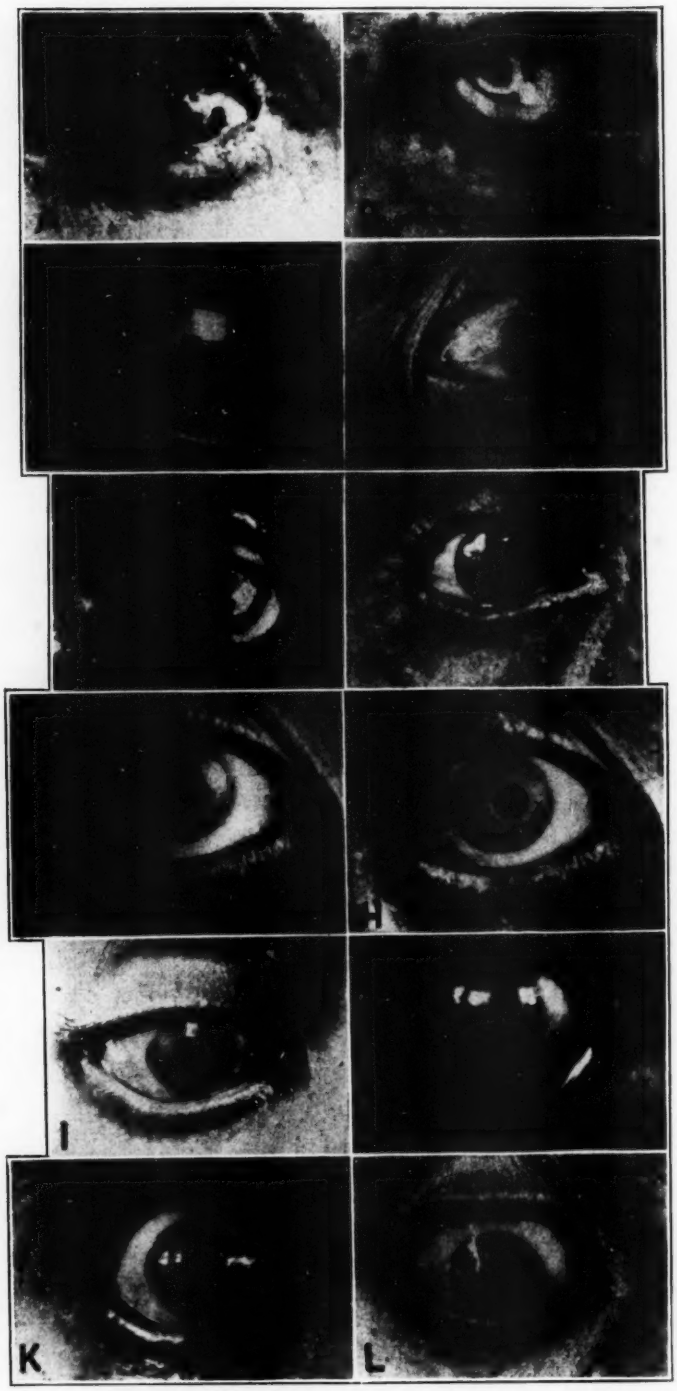

Fig. 7.—Eyes in which partial penetrating transplantation was successfully performed: *A* to *L* illustrate cases 1 to 14 of the text.

CASE 3 (Slepenko).—Leukoma developed after syphilitic parenchymatous keratitis; there was slight buphthalmos. The patient was suffering from recurring keratitis. Vision before the operation was perception of hand movements; after the operation vision improved to 1, but after a recurrence of keratoscleritis it dropped to 4/100 and remained for two years without change; three years later, before the patient's death, it declined to 1/60. The impairment of vision occurred, not because of the opacity of the transplant, but because of a lesion in the macula lutea, the existence of which was proved on histologic examination. The picture shown in figure 7 *C* was taken within one year after the operation. The eye looked the same before the patient's death.

CASE 4 (Dolzhenko).—This was a case of leukoma, slightly ectatic, which occurred after blennorrhea, and which had some transparent remainders of the corneal tissue. Vision improved after the operation from perception of light to 1/60. The strip of cornea for transplantation and the opening in the leukoma were made with a knife and scissors (Filatov[32]). Vision remained unchanged within two years of observation. The picture (fig. 7 *D*) was taken one year after the operation.

CASE 5 (Neizvestnovsky).—A total leukoma developed after scrofulous keratitis, with some transparent corneal tissue. The projection of light was faulty. The transplant kept its transparency during one year of observation. The thick opacity of the vitreous could be seen through the transplant (Filatov and Velter[33a]).

CASE 6 (Fialkovsky).—The patient had a cicatricial leukoma after an injury, with some transparent corneal lamellae left on the periphery. Vision was perception of hand movements at a distance of 0.5 meter. The first transplantation was performed by von Hippel's method, but it did not give a transparent taking. The second operation was made with Holth's instrument. The transplant kept some transparency during the period of observation (fourteen months), and vision was 1/60. The picture (fig. 7 *E*) was taken within fourteen months (Filatov and Velter[33a]).

CASE 7 (Adamchuk).—The eye showed a dense opacity after parenchymatous keratitis. The patient could count fingers at a distance of 1 meter. The transplanted cornea has kept a gratifying transparency during the period of observation, two years and six months. Vision was 7/10; in three years and a half the vision declined to 4/10. Before the operation the patient was an invalid; now he can work; he has been farming. The picture (fig. 7 *F*) was taken eighteen months after the operation.

CASE 8 (Severin).—A dense opacity developed after parenchymatous keratitis. Before the operation vision equaled 1/120. The transplanted cornea kept a fair transparency during the period of observation of five and one-half months. Vision was 3/60, and it was the same until the patient's death, seven and one-half months after the operation. The picture (fig. 7 *G* and *H*) was taken five months after the operation; it is not retouched, and the transplant has a dull appearance. Figure 7 *H* is a more natural representation of the transplant than figure 7 *G*.

CASE 9 (Kalabukov).—A cicatricial opacity of the cornea followed an injury. There was a small strip of semitransparent corneal tissue on its periphery. Vision

32. Filatov: A Case of Corneal Autotransplantation, Russk. oftal. j. **13**:305, 1931.

33. Filatov and Velter: (*a*) Materialen zur Frage der durchgreifenden partiellen Hornhauttransplantation, Arch. f. Augenh. **106**:467, 1932; (*b*) Further Observation of Partial Penetrating Corneal Transplantation, Sovet. vestnik oftal. **4**:5, 1934.

was perception of light. After the operation the transplant was transparent, but vision did not improve, because of the presence of scar tissue behind the transplant. The attempt to remove the scar tissue by an operation was not successful. Twelve months after the operation the transplant was still transparent, but there was a thick gray membrane behind it. Vision was perception of light.

CASE 10 (Ilyin).—In the right eye were a dense opacity in the central part of the cornea and a less dense one on its periphery both of which developed after parenchymatous keratitis. Before operation vision was 3/60. The transplant kept a good transparency during the period of observation, which was twenty-eight months. Vision was 5/10, with correction of the astigmatism. The picture (fig. 7 *I*) was taken eight months after the operation.

CASE 11 (Ilyin).—In the left eye was an opacity which occurred after parenchymatous keratitis. Vision before operation was 5/60. The operation was performed by Filatov's method. The transplant united well and has kept its transparency, but it was necessary to perform several iridectomies to remove the anterior synechiae. The vision twenty-seven months after the operation was 3/10. The patient could not work and was illiterate. After the operation he learned to read. The picture (fig. 7 *J*) was taken seven months after operation. The eye looks about the same now, twenty-seven months after the operation (Filatov and Velter [33b]).

CASE 12 (Ksenzova).—Opacity developed after parenchymatous keratitis. Vision before operation was 3/60; after operation it was 2/10. The period of observation was fourteen months (fig. 7 *K*).

CASE 13 (Lisin).—A leukoma occurred after a traumatic ulcer. In the upper part of the cornea there was present a strip of transparent corneal tissue. Vision before operation was 1/60; after operation it improved to 4/10. The operation was performed by Zykulenko, assistant in the Eye Clinic of the Odessa Medical Institute. Binocular vision was reestablished. The picture (fig. 7 *L*) was taken six months after the operation (Zykulenko and Velter [34]). The period of observation was thirty-one months.

CASE 14 (Boguta).—Cicatricial opacity of the cornea after burns with acetic acid. Vision before operation was 1/60. The operation was performed by Filatov's method. The transplant kept its transparency during one year of observation. Vision was 3/60; with a convex lens —10, it was 1/10. This case will be described in more detail in another article.

SOCIAL SIGNIFICANCE OF CORNEAL TRANSPLANTATION

According to the official statistics [35] there are in the U. S. S. R. 238,000 persons incurably blind in both eyes: 20.64 per cent became blind from trachoma; 21.8 per cent from glaucoma; 8.43 per cent from diseased cornea; 10.63 per cent from smallpox; 3.54 per cent from blennorrhea; 6.56 per cent from injuries; 4.06 per cent from diseases of the optic nerve; 3.62 per cent from syphilis; 1.56 per cent from disease of the uveal tract; 2.41 per cent from congenital blindness;

34. Zykulenko and Velter: Transparent Healing of the Transplanted Cornea, Klin. Monatsbl. f. Augenh. **9**:44, 1933.

35. Golovine: Blindness in Russia, Odessa, 1910. Savvaitoff: Blindness in the Union of Soviet Socialist Republics, Sovet. vestnik oftal. **1**:2, 1932.

1.19 per cent from diseases of the central nervous system; 4.83 per cent from general diseases, and 10.82 per cent from unknown causes.

Since the cornea is affected in trachoma, smallpox, blennorrhea, some injuries and syphilis, it can be estimated that almost 45 per cent of blindness is caused by leukoma. Of the 117,000 persons affected, many thousands are candidates for corneal transplantation. Many of these have some remainders of clear corneal elements, and they may have good chances of regaining their vision. There are more candidates among people with poor vision due to leukoma who did not enter into the statistics. Even in the present state of its development corneal transplantation could be beneficial to a great number of blind and invalid persons whose cornea still has transparent elements.[36]

PROBLEM OF ORGANIZATION

Blind people with leukomas should be informed by articles in magazines and by leaflets of an educational character about the possibility of their being cured of their blindness.

In the dispensaries, oculists who know the indications and contraindications for the operation should look among the patients for leukomas which require the operation and which have some clear corneal tissue left.

Since the demand for corneal grafting has increased, it is necessary to increase the material for it. It is necessary, first of all, to use the eyes enucleated from patients. There are in the hospitals and clinics quite a few cases in which enucleation is done, but even if one cornea is used for two patients, it will be possible to satisfy only a small number of persons requiring the operation.

The problem of using the material of cadavers should be investigated thoroughly. A general study of this question requires money, time and organization. The Ukrainian Departments of Health and Justice, of the U. S. S. R., took important steps to simplify the process of obtaining cadavers' eyes. It is necessary to study the methods of preservation of the material at a certain temperature and under aseptic conditions.

SUMMARY AND CONCLUSIONS

1. Partial penetrating corneal transplantation occupies the most important place among the various types of this operation. Total corneal transplantation is still in the experimental stage. The transplantation of part of the corneal layers for optical purposes has limited indications. I have been studying the effect of the latter operation on the "ameliora-

36. Outside of the Eye Clinic of the Odessa Medical Institute there were reported in the U. S. S. R. seven other successful corneal transplantations; of these, three were reported by Orlov, three by Beliayeff and one by Wasiutinsky.

tion" of the operative field in rough cicatrices for the purpose of performing a partial penetrating transplantation later on.

2. In the period from 1923 to 1932, I performed ninety-six partial penetrating corneal transplantations. Of these, fourteen gave a permanent transparent union of the transplant; they were observed from one to six years, except that of one patient who died seven and one-half months after the operation. In two patients vision was not improved. In the others it was increased from 1/60 to 30/60.

The successful cases can be classified as follows, according to the quality of the operative field: (*a*) In thirty-eight eyes with leukoma complicated with glaucoma, buphthalmos, applanation of the cornea and symblepharon, forty-eight operations gave no positive results. (*b*) Of twenty-two rough cicatricial leukomas, only in a few was a transparent taking of the transplant obtained. (*c*) All successful transplantations were done in those twenty-six leukomas in which some transparent corneal tissue remained—in 54 per cent. Thus my material confirms Elschnig's rule as to the importance for a successful transplantation of the presence of corneal tissue in the leukoma.

4. I used, besides von Hippel's and Elschnig's technic, my own method, the essence of which is that an ivory plate or spatula is used in the anterior chamber. This spatula serves two purposes: It prevents injury of the lens and prolapse of the vitreous.

I used successfully the trephine which Marzinkowsky and I invented and which represents a combination of the trephine and the spatula.

5. Various methods of fixation of the transplant (conjunctival flap, egg film) and the method for stopping prolapse of the vitreous have been described.

6. Favorable results were obtained with cadavers' eyes, which were conserved at from 4 to 6 C. (thirty-five cases).

7. If the eye presents "poor soil" for transplantation, it must be improved by preliminary operations. I have sought to find new principles for the control of glaucoma. For cleaning the scars off the posterior surface of the leukoma, I perform *exenteratio retrocornealis anterior partialis*. The amelioration of rough cicatrices is performed as follows: The scar is cut away in layers; the raw surface is covered with corneal layers, which are fixed with a conjunctival flap.

8. In the process of the union of the transplant experiments have been made with Carrel's material (baths in chicken embryo juice), also with Fisher's desmons.

9. In accordance with the pathologic observations in one case of transparent union of the transplant and in accordance with the literature it is believed that corneal transplantation in the true sense of this word is possible.

ADDITIONAL REFERENCES

Filatov: How to Keep the Transplanted Cornea Viable, Ztschr. f. Augenh. **69**:18, 1929; Ein Fall von Hornhauttransplantation, Arch. f. Augenh. **102**:716, 1930; Transplantation of the Cornea, Novy khir. arkhiv. **28**:302, 1933; On the Technic of the Partial Penetrating Corneal Transplantation, Sovet. vestnik oftal. **4**:2, 1934.

Filatov and Velter: Partial Corneal Transplantation of the Cornea, Sovet. vestnik oftal. **1**:13, 1932; Corneal Transplantation, ibid. **1**:15, 1932.

SHORT STUDIES ON THE HISTORY OF OPHTHALMOLOGY

I. THE COMING OF THE OPHTHALMOSCOPE INTO ENGLAND

BURTON CHANCE, M.D.
PHILADELPHIA

The golden age of ophthalmology was inaugurated by Helmholtz' invention of the ophthalmoscope and the publication in Berlin, in 1851, of his immortal "Beschreibung eines Augen-Spiegels," which was "the description of an optical instrument by which it is possible in the living to see and recognize exactly the retina itself and the image of luminous objects which are cast upon it."

It had been the desire of all students of the eye and of those who treated its diseases some day to see the interior of the living organ, but this accomplishment was regarded as impossible, because it was supposed that light shining into the eye was completely absorbed by the choroidal pigment and that none could be returned to the observer. The usefulness of the ophthalmoscope depends, however, on the principle that on illuminating the eye by a beam of light and examining it in the same direction as the line of the beam, as it is cast into the eye, the deeper parts can be rendered visible. Accordingly all forms of ophthalmoscopes which have been invented, no matter how simple or how complicated, were constructed in accordance with this principle.

The discovery of the ophthalmoscope was not simply a lucky hit, but was, on the contrary, "the mature offspring of theory." It was only by patient and earnest search through the facts relating to vision and accommodation, as well as to the properties of reflectors and lenses, for the means with which to fulfil its purpose that a usable instrument was invented. The invention, therefore, became the starting point from which all subsequent advances in ocular physiology and pathology have proceeded.

It is not intended in this brief essay to enumerate the speculations as to the cause of the natural luminosity of animals' eyes or to detail the efforts made throughout the ages to illuminate the interior of the human eye. Yet, one may recall Méry's [1] success, in 1704, in seeing the retinal vessels in the eyes of a cat held under water; La Hire's [2] explanation, in 1709, that the possibility of seeing the vessels was due to the change in the refraction of the rays which made the eye

1. Méry: Hist. de l'Acad. roy. d. sc., Paris, 1704, p. 14.
2. La Hire: Hist. de l'Acad. roy. d. sc., Paris, 1709, p. 90.

luminous; and the fact that, in 1847, while examining the eyes of his friend Du Bois Reymond, Brücke [3] discovered the emission of light from the eye, a phenomenon which, had he pursued his observation further, might have led Brücke to invent the ophthalmoscope.

BESCHREIBUNG

EINES

AUGEN-SPIEGELS

ZUR UNTERSUCHUNG

DER NETZHAUT IM LEBENDEN AUGE

VON

H. HELMHOLTZ,

PROFESSOR DER PHYSIOLOGIE! AN DER UNIVERSITAET ZU KOENIGSBERG.

BERLIN,

A. FORSTNER'SCHE VERLAGSBUCHHANDLUNG.

(F. JEANRENAUD.)

1851.

Fig. 1.—Reproduction of the title page of Helmholtz' "Beschreibung eines Augen-Spiegels."

Every discovery in the history of science had a period of preparation before the genius who called the fact into being appeared. Among certain practitioners in England, from 1835 toward the middle of the

3. von Brücke: Ueber das Leuchten des menschlichen Auges, Arch. f. Anat., Physiol. u. wissench. Med., 1847, pp. 225 and 479.

century, there seemed to have been an air of expectancy of an epoch-making discovery. The period of "clinical intuition," instituted in the time of Mackenzie, had exhausted all that could be studied by the unaided eye. Serious-minded practitioners became conscious of their lack of knowledge regarding many diseases of the organ which they as oculists proposed to treat.

In the course of time the idea of an instrument with which one could view the interior of the eye was suggested by William Cumming, a young surgeon who was working at the Royal London Ophthalmic Hospital, and a model was actually constructed by Charles Babbage,

Fig. 2.—Portrait of William Cumming from the history of Moorfields by Treacher Collins.

a professor of mathematics at Cambridge, a number of years before Helmholtz devised his ophthalmoscope. In the *Medico-Chirurgical Transactions* for 1846 Cumming,[4] in his article "On a Luminous Appearance of the Human Eye," demonstrated that the color of the living retina could readily be seen when an observer so placed himself that his eye was in the line of the rays of light falling on the retina of the eye examined. Cumming proved that the interior of the eye is not a dull black but rather a light colored reflecting surface. He was able to distinguish as normal certain colored appearances in the depth of

4. Cumming, W.: Med.-Chir. Tr., London **29**:284, 1846.

the eye, such as an increase or a decrease in the pigmentation, which hitherto had been regarded by various observers as pathologic. Cumming never saw the optic nerve, nor did he obtain a view of the retinal vessels. His experiments, however, prepared the way for more complete

Fig. 3.—Original model of Helmholtz' ophthalmoscope.

revelations by others. He died in 1855, at the age of 33, but lived to see the realization of what he had foretold.

Babbage was an inventor of calculating machines and other instruments of precision, but he was incapable of comprehending the needs of the case; neither did the ophthalmic surgeon to whom he showed his model recognize the importance of his invention. According to

the statement made by Wharton Jones in a "Report on the Ophthalmoscope" in the periodical *Medico-Chirurgical Review* in 1854, Babbage's instrument consisted of a tube blackened within and carrying at the proximate end a mirror of silvered glass set at such an angle that the light as it was directed into the object eye fell on it through an opening in the side of the tube. The silvering was removed from the center of the mirror to afford a sight hole. The distal end was to rest on

Fig. 4.—Portrait of Helmholtz.

the patient's orbit. This instrument could have been used only in emmetropia or hyperopia; a concave lens would have been required for the observation of the myopic eye.

These two pioneers were unfortunate, however, in that their instruments were regarded as "mere toys" by those to whom they exhibited them, and their devices were laid aside without any one making known what they had accomplished. The principles for the illumination of the depths of the eye, therefore, had to be rediscovered by Helmholtz, and it is to him that the credit belongs.

Helmholtz' "eyespeculum," which he called an "ophthalmoscope," was originally used in the physiologic laboratory. It was not easily manipulated by the ophthalmic surgeon, so that almost immediately modifications began to be suggested. (I remember seeing and handling a Helmholtz ophthalmoscope early in my course at Wills Hospital, but as not even the eldest ophthalmologist there could show me how to use it, I never learned its mysteries.)

Helmholtz, however, was convinced of the practical utility of his discovery and in the "Beschreibung,"[5] he modestly yet fearlessly prophesied as follows:

I do not doubt, judging from what can be seen of the state of the healthy retina, that it will be possible to discern all its diseased conditions, so far as these, if seated in other transparent parts, such as the cornea, would admit of diagnosis by the sense of sight. Distension or varicosity of the retinal vessels will

Fig. 5.—Portrait of Ruete.

be easily perceptible. Exudations in the retinal substances, or between the retina and choroid, will be seen precisely as in the cornea, by their brightness upon a dark ground. . . . Fibrinous exudations, usually much less transparent than the ocular media, will, when lying upon the fundus, considerably increase its reflection. I believe, also, that turbidiy of the vitreous body will be determined with greatly increased ease and certainty. . . . In brief, I do not consider it an overstrained expectation that all the morbid changes of the retina or the vitreous body that have been found in the dead subject will admit of recognition in the living eye; an expectation that appears to promise the greatest progress in the hitherto incomplete pathology of the organ.

The exhibition of Helmholtz' model excited a remarkable spirit of invention. In December 1851 Donders[6] of Amsterdam presented a model

5. Zander, A.: The Ophthalmoscope, Its Varieties and Its Use, translated from the German by R. B. Carter, London, R. Hardwicke, 1864.

6. Donders, F.: Beschreibung eines Augenspiegels, Nederl. Lancet **1**:739, 1851-1852.

in which the movable glass plates of Helmholtz' instrument were replaced by a mirror from the back of which the silver was removed to afford a sight-hole. Thenceforth, and until the present, modifications and other changes have been made in greater number than in any other instrument in medicine.

In 1852 Ruete [7] of Göttingen invented an ophthalmoscope constructed on a principle entirely different from that of Helmholtz, the light being thrown on the retina by means of a concave mirror as the observer looked through a small hole in the center. This simple form was adapted to nearly all the instruments subsequently devised. New models appeared rapidly, and within the decade of the publication of

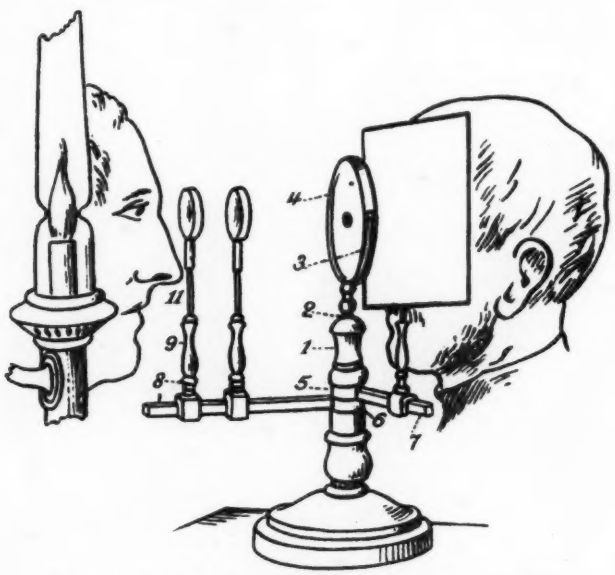

Fig. 6.—Ruete's ophthalmoscope designed in 1852.

Helmholtz' work easily manipulated mirrors known by the names of their inventors, such as Coccius' [8] (fig. 7), with Carter's modification, Zehender's [9] (fig. 8), Anagnostakis' [10] (fig. 9) and Liebreich's [11] (figs. 10

7. Ruete, C. G. T.: Der Augenspiegel und das Optometer, Göttingen, Dieterich, 1852.

8. Coccius, E. A.: Ueber die Anwendung des Augenspiegels nebst Angabe eines neuen Instrumentes, Leipzig, I. Müller, 1853.

9. Zehender, W.: Neuer Augenspiegel, Ztschr. d. Gesellsch. d. Wien. Aertze, 1853, no. 12.

10. Anagnostakis, A.: Essai sur l'exploration de la rétine et des milieux de l'oeil sur le vivant au moyen d'un nouvel ophthalmoscope, Paris, Rignoux, 1854.

11. Liebreich: Beschreibung eines Augenspiegels, Arch. f. Ophth. (Abt. 2) **1**:348, 1855.

and 11), could be obtained. The simplest forms consisted of a single slightly concave mirror perforated in the center and fixed on a handle. The mirror was used either alone, much like the modern skiascopic

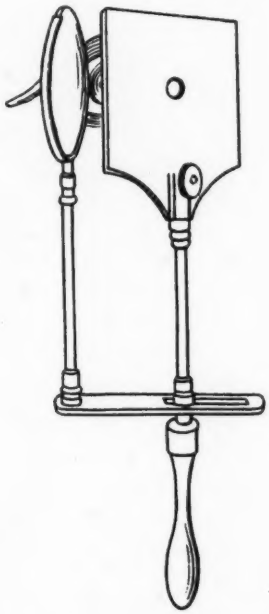

Fig. 7.—Coccius' ophthalmoscope designed in 1853.

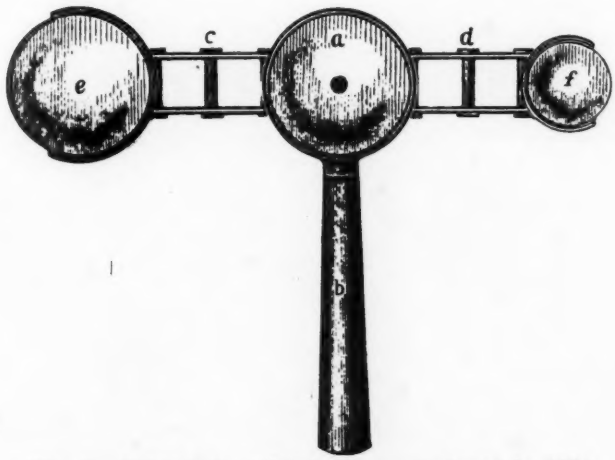

Fig. 8.—Zehender's ophthalmoscope designed in 1854.

mirror, or with the addition of a convex or concave glass adjustable by a bracket attached to the stem of the mirror handle. Accompanying the mirror was a separate convex lens of about a 2 inch (5 cm.) focus.

The first mechanical improvement was made by Rekoss, of Koenigsberg; it consisted of revolving disks carrying a series of lenses with which combinations of any two lenses could be made (fig. 14). A small spring kept the disks in place behind the sight-hole in the concave mirror. When one views an exhibition of a collection of ophthalmoscopes arranged in historical sequence, such as that prepared by H. V. Cornell and Davis, at the Army Medical Museum, Washington, D. C., one is struck by the singular lack of appreciation of the practical value of Rekoss' adjunct, and one marvels that for several years after it was devised all sorts of cumbersome contrivances were constructed, none

Fig. 9.—Anagnostakis' ophthalmoscope.

of which utilized this perfectly simple and easily manipulated lens carrier.

The completed invention itself created but little interest among ophthalmologists. It was believed that "the intense light from the ophthalmoscope shining for so long a time and in such concentration would irritate the retina, cause congestion, and inflict much mischief upon an inflamed eye." All examinations were carried on with the pupil widely dilated by atropine, by the indirect method, and, as the images were inverted, much confusion arose. Of course, as only gross images were obtained, it was likely that the early stages of pathologic changes eluded observation; this caused Dixon to declare, in his "Guide to the Practical Study of Diseases of the Eye," published in 1859, "that the invention of the ophthalmoscope was perhaps too enthusiastically hailed

as a means of clearing up all the obscurity which had surrounded the pathology of the choroid and retina." The great Mackenzie himself made little use of the ophthalmoscope. He never became expert with

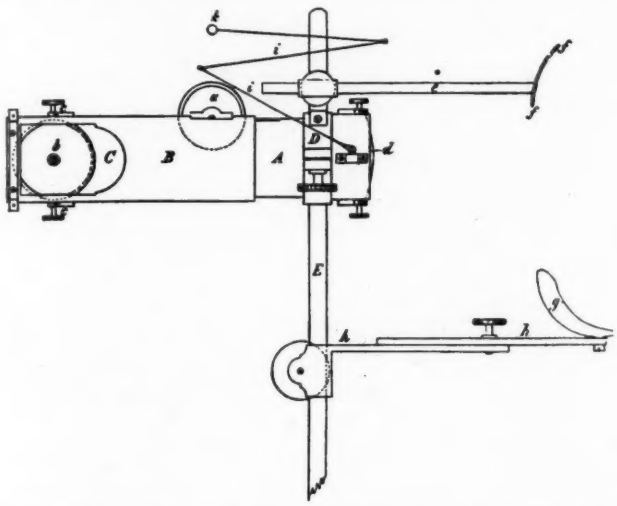

Fig. 10.—Liebreich's stationary ophthalmoscope designed in 1854.

Fig. 11.—Liebreich's simple ophthalmoscope designed in 1855.

it; indeed, its use required more time and pains than he was willing to take. He did not seem to comprehend its powers, as he could not see how one could study the pathologic departures from normal. In

the 1854 edition of his textbook, he dismissed the subject of the ophthalmoscope somewhat as follows: "Such examinations may confirm us in an unfavorable prognosis, already pronounced on other grounds, but are not likely to be either satisfactory or safe in the early and curable stages of disease."

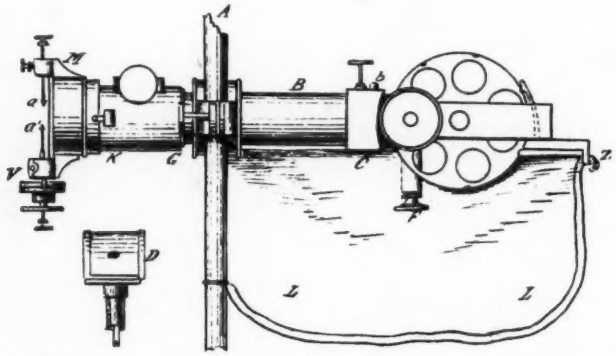

Fig. 12.—Ophthalmoscope designed by Epkens and Donders in 1852.

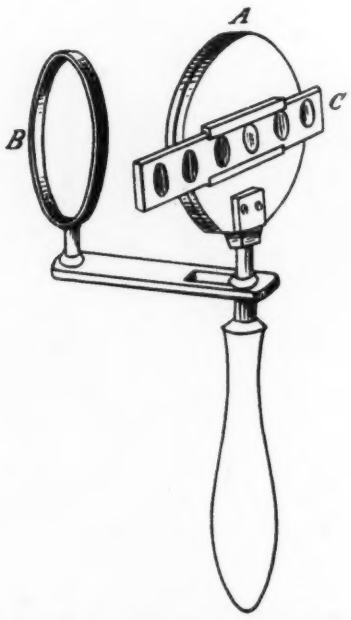

Fig. 13.—Coccius' ophthalmoscope designed in 1859.

In the preophthalmoscopic days, amaurosis from cerebral causes was generally regarded as being caused by simple paralysis of the optic nerve; a descending neuritis was never thought of until it became possible to study the interior of the eye by means of the mirror. The statements concerning the destructiveness of glaucoma were merely speculative.

In the treatises of the day notices regarding the ophthalmoscope were generally meager and inaccurate. Wharton Jones, in the 1855 edition of his "Principles and Practice of Ophthalmic Medicine and Surgery," devoted one or two pages to a description of the ophthalmoscope and stated that "The use of the instrument is necessarily limited to the capacity of the eye to bear the light."

It is difficult to say who made the first important and careful observation through the ophthalmoscope. In 1852 Ruete described several departures from what he considered to be the normal appearances, and

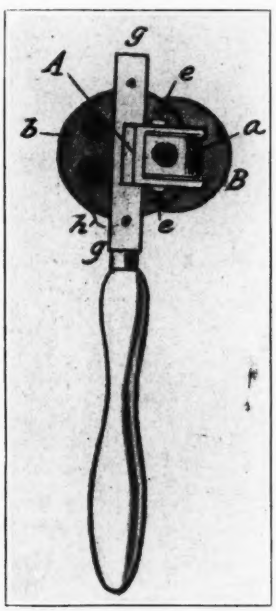

Fig. 14.—Rekoss' disk.

in the following year Coccius observed detachment of the retina and indicated what is now known to be retinitis pigmentosa. Yet, Sichel and von Graefe [12] may be regarded as the earliest workers in the ophthalmoscopic field of observation on the continent. In England, as early as 1853, Spencer Wells [13] (1818-1897) divined the great value of it in the study of disease of the eye. Wells, who became famous as an ovariotomist, started to practice in Leeds as an ophthalmic surgeon.

Helmholtz himself was not aware that his invention had become the instrument that was to open a new era in ophthalmology. He sent his instrument to von Graefe, who was more appreciative than the English, and who, perceiving its probable value, commenced to employ

12. von Graefe: Arch. f. Ophth. 1854, vol. 1, preface p. VI

13. Wells, Spencer: M. Times & Gaz. **7**:265, 1853.

it as a means of research. One can well imagine with what excitement von Graefe first beheld the living human fundus, uttering his cry, "Helmholtz has unfolded to us a new world. What remains to be discovered?" At the Heidelberg Congress, in 1858, he was moved to say:

. . . under our eyes we see the mists disperse, which, for hundreds of years, have clouded the view of our best observers, and an unexampled field is won for

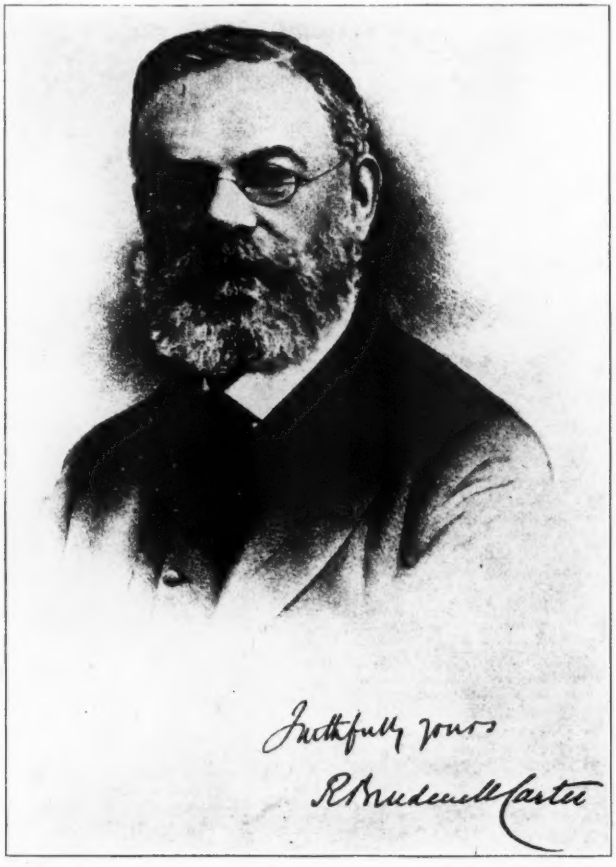

Fig. 15.—Portrait of R. B. Carter.

the healing art, from which, even already, after a few brief years, have been reaped most admirable fruits.

It was von Graefe's [14] well known essay which, for all succeeding generations, drew attention to the importance of ophthalmoscopy. The studies of the pathologic changes of the disk and vessels were thenceforth vigorously prosecuted on the continent by Saemisch, Liebreich,

14. von Graefe: Ueber Complication von Sehnervenentzündung mit Gehirnkrankheiten, Arch. f. Ophth. **2:** 58, 1860.

Schweigger and Desmarres, and in England by Jonathan Hutchinson, Brudenell Carter (fig. 15) and Hughlings Jackson and, soon after, by Clifford Allbutt.

It is a singular fact in the history of ophthalmology in England that, on the realization of the value of the ophthalmoscope as an instrument of precision, the earliest contributions to the science were made by a group of observers who were not strictly ophthalmologists but men deeply immersed in surgical and general medical practice. One need only examine the early numbers of the *Ophthalmic Review* and the *Ophthalmic Hospital Reports* to learn how medical the subjects of the articles therein published are. The chief observer in the decade following the invention was Jonathan Hutchinson, who received an impetus to become interested in ophthalmology from Sir William Lawrence, the doyen of ophthalmic practitioners. Hutchinson, in turn, inspired Hughlings Jackson to employ the ophthalmoscope in his neurologic study, and it was Jackson who encouraged Clifford Allbutt, following the suggestion which had been made to him by J. W. Ogle, of St. George's Hospital, to use the mirror in his investigations in cerebral disease.

Because Hutchinson, Jackson and Allbutt did not ally themselves with the practice of ophthalmology but were engaged for many years in other departments of medicine, it has been deemed appropriate that their memories should be revived, to remind those who are today engrossed in the practice of "the first" of the specialties that the later groundwork of the principles of practice in their several departments was laid for them by distinguished scientists who, in their own various branches, owed their success to the training in clinical observation which they had received in the earliest days of their professional careers through the serious interest which they had taken in ophthalmologic subjects.

It is the desire of the editors of the ARCHIVES OF OPHTHALMOLOGY to issue from time to time short biographies of distinguished scientists and practitioners whose names ought not to be forgotten, because their labors have formed the web and woof of the fabric of modern ophthalmology. The sketches will be used to recall briefly the outstanding contributions which each one made, in order that his name may survive in the minds of the younger men, some of whom are to be the great men of this and of the next generation.

In the early numbers of the ARCHIVES sketches of the lives of scientists already named and of others will be given.

Major V. H. Cornell, Curator of the Army Medical Museum, Washington, and his associates aided in the researches of the literature on the ophthalmoscope and furnished some of the illustrations for this brief essay.

SYMPATHECTOMY FOR RETINITIS PIGMENTOSA

ALEXANDER E. MacDONALD, M.D.

AND

KENNETH G. McKENZIE, M.D.

TORONTO, CANADA

In September 1930, Royle [1] stimulated interest in the treatment of retinitis pigmentosa by stating that the vision of patients with this disease could be improved by the surgical interruption of the sympathetic nerves to the eye. Our experience with this form of treatment has been limited to four cases. Although the results have not been particularly encouraging, we believe that they should be placed on record.

Success has attended the efforts of individual workers in treating retinitis pigmentosa with other measures, but their good results have not been duplicated by independent trials. Galvanism was used by Dor [2] and Gunn.[3] Mayou [4] tried amyl nitrite, paracentesis and trephining; Doyne [5] employed the operation for cataract, which was also used by Knapp [6] in four cases, without improvement. Roentgen treatment was used in 1928 by Merkulow and Schick,[7] acetylcholine by Corrado [8] and female sex hormone by Wibaut,[9] while Levine [10] has used vitamin A in the form of large doses of cod liver oil. The evidence gained from a review of the literature is that treatment is of no avail.

We were critical of Royle's reported successes, but we believed that this procedure was warranted in dealing with a condition generally regarded as hopeless, and Dr. McKenzie thought that the technical difficulties and anatomic changes would not be too severe.

Read at the Seventieth Annual Meeting of the American Ophthalmological Society, Lucerne, Canada, July 10, 1934.

1. Royle: M. J. Australia **2**:364 (Sept.) 1930; **2**:111 (July) 1932.
2. Dor: Arch. f. Ophth. **19**:342, 1873.
3. Gunn: Roy. London Ophth. Hosp. Rep. **10**:161, 1881.
4. Mayou, M. S.: Tr. Ophth. Soc. U. Kingdom **36**:350, 1916.
5. Doyne: Ophthalmoscope **8**:505, 1910.
6. Knapp, A.: Cataract in Retinitis Pigmentosa; Pathology and Treatment, Arch. Ophth. **47**:612 (Nov.) 1918.
7. Merkulow, J., and Schick, J.: Klin. Monatsbl. f. Augenh. **81**:844 (Dec.) 1928.
8. Corrado: Ann. di ottal. e clin. ocul. **61**:43, 1933.
9. Wibaut, F.: Deutsche med. Wchnschr. **57**:1739 (Oct. 9) 1931.
10. Levine, J.: Is Retinitis Pigmentosa Due to Vitamin Deficiency? Arch. Ophth. **9**:453 (March) 1933.

Sympathectomy is not a modern operation. De Schweinitz and his co-workers [11] quoted de Petit (1727), who had stated that the ipsilateral globe was softer after cervical section, and in 1889 Alexander [12] reported his results following this operation for epilepsy. Edmonds [13] revived the procedure in 1895, and Jaboulay [14] reported in 1897 the results of the sympathectomy for exophthalmic goiter. Abadie,[15] in 1897, proposed sympathectomy as a means of surgical treatment for glaucoma; Elschnig, Rhomer and Wilder [16] reported cases with a mortality of 9.3 per cent and found the results unsatisfactory. Jonnesco,[17] in 1898, reported good results if no atrophy was present in the glaucomatous eye. However, the operation fell into disregard.

In general, surgical sympathectomy is used for many conditions, such as angina pectoris, Raynaud's disease and Hirschsprung's disease. The literature is extensive and of little interest in ophthalmology.

Royle [1] reported six cases, in three of which the patient was over 50 years of age.

Campbell [18] reported a successful result with an increased field of vision and low tension in the eye on the side on which the operation was performed.

Meighen [19] reported successful treatment in a man, aged 20, who gained better vision and a larger visual field.

Caeiro, Malbran and Balza [20] recently reported five cases, in only two of which the patient was under 30 years of age; unfortunately, the visual fields were not given.

Our cases were as follows:

REPORT OF CASES

CASE 1.—*History.*—A white man, aged 47, was admitted to the hospital on June 18, 1931, and discharged on July 1. He complained of difficulty in seeing, especially in the dark, for fifteen years. He saw much better in daylight. Six years before he had turned his head away for a moment while driving a car; the car went over a high bank, and he had not driven since. He had worn glasses

11. de Schweinitz, Wilder, Ball and Weeks: The Relationship of the Cervical Sympathetic to the Eye, Chicago, American Medical Association Press, 1904.

12. Alexander, in Gask and Ross: Surgery of Sympathetic Nervous System, London, Baillière, Tindall & Cox, 1934, p. 21.

13. Edmonds: Tr. Path. Soc. London **46**:230, 1895.

14. Jaboulay: Tr. Internat. M. Cong., p. 515.

15. Abadie, C.: Arch. d'opht. **16**:667, 1896.

16. Elschnig, Rhomer and Wilder: Encyclopedia of Ophthalmology, vol. 7, p 5566.

17. Jonnesco, T.: Bull. Acad. de méd., Paris **84**:93, 1920.

18. Campbell, Glen: Canad. M. A. J. **26**:674 (June) 1932.

19. Meighen: Tr. Ophth. Soc. U. Kingdom **51**:124, 1931.

20. Caeiro, Malbran and Balza: Rev. Asoc. méd. argent. **47**:3403, 1933.

at intervals since the accident, with little help. Three months before examination he was sent by an insurance company to have his eyes examined, and the diagnosis of retinitis pigmentosa was made. He had always been healthy, except for a fractured collar bone, which had healed well.

Family History.—There was no visual defect in four children; two of them were examined. The families of the patient's mother and father had no ocular trouble, nor had his brothers or sisters.

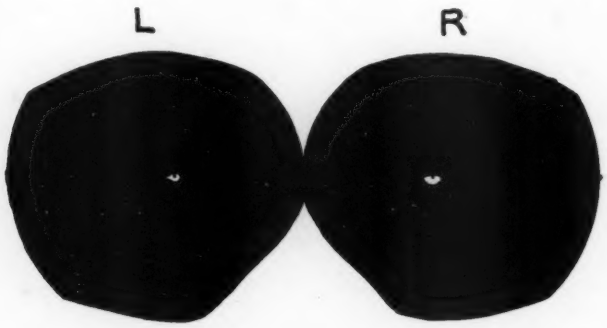

Fig. 1 (case 1).—Fields on June 20, 1931, before operation, taken with a 10 mm. test object on a Bjerrum screen at 2 meters. Cooperation and light were good. Vision was 5/60 in the left eye and 6/60 + 1 in the right. In all the figures *L* indicates the left field and *R* the right.

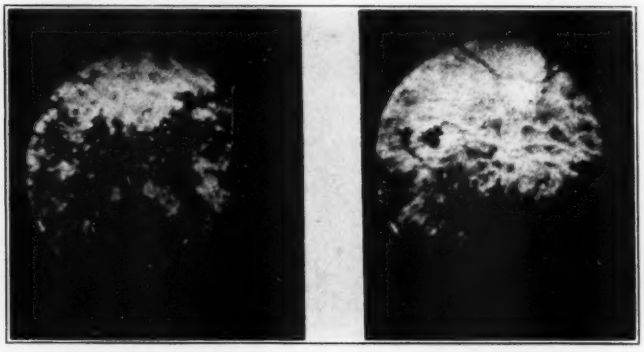

Fig. 2 (case 1).—Photographs of the fundi after operation, showing vitreous opacities with patches of pigment.

General Examination.—The patient was well developed, but not well nourished, and was bright and intelligent. Examination showed upper teeth missing; nearly all the lower teeth were present. The head, chest, abdomen and genitals showed no features of interest. The cranial nerves other than those of the eye showed nothing of interest, nor did the arms, trunk, legs, gait or stance.

Ophthalmic Examination.—The pupils were small and did not react to light or in convergence. The ocular movements were normal, and the margins of the disks clear. There was slight connective tissue along the vessels, which were extremely small. The choroidal vessels were visible. The macula showed a poor

central reflex. Near the equator were numerous patches of black pigment, which obscured the vessels. There were a few fine flecks of pigment near the foveola.

On June 20 the right pupil was slightly larger than the left and reacted sluggishly to light and consensually. The fundi showed numerous vitreous opacities, with marked patches of pigment. Both disks were gray.

Operation.—On June 22 section of the sympathetic trunk below the second thoracic ganglion was performed.

Laboratory Examination.—The Wassermann reaction was negative; the urine was normal.

Further Ophthalmic Examination.—On Oct. 24, 1933, Dr. R. J. P. McCulloch reported that vision in the right eye was 6/60, and that in the left, 5/60; both fields were contracted to the fixation point.

CASE 2.—*History.*—J. J., a white man, aged 24, a truck driver, was admitted from the service of Dr. C. Hill to Dr. McKenzie's service on Sept. 8, 1931, and discharged on October 1. The chief complaint was failing vision for eighteen years. At about 7 years of age he noticed that vision was defective, and glasses were obtained. Failure in vision continued steadily until he came to the hospital. He had always had good health, except for measles, mumps and chickenpox as a child. There were no complications. The mother had poor eyesight, but the sister's eyesight was good. The father's sight was normal. Three children were dead.

General Examination.—Examination for functional disorders gave negative results. There were no symptoms of genito-urinary disorders. The cranial nerves with the exception of those of the eyes appeared normal, and all the other results of examination were negative.

Ophthalmic Examination.—Vision in the right eye was 6/60, and that in the left 6/36.

The fundus of the right eye had slightly blurred margins of the disk and a halo of pigment. The vessels of both eyes were small, and the disks were gray. There were many black pigmented areas superficial to the vessels; these were 3 disk diameters from the nerve head. The pupils were round, equal and regular and reacted to light and consensually. The ocular movements were normal, with no nystagmus or ptosis; the corneal reflexes were equal and active.

Operation and Course.—On September 15 the right stellate and second thoracic ganglions were removed. On October 1 examination of the fundi showed no apparent change; the right pupil was smaller than the left. The fields are shown in figure 3.

Laboratory Examination.—The Wassermann reaction was negative; urinalysis showed no albumin or sugar, and the results of other examinations were negative.

Subsequent Course.—The patient made an uninterrupted recovery and was discharged on October 1. On Oct. 4, 1933, Dr. Kazdan reported no noticeable alteration in the appearance of the fundi or vessels. The fields showed a further equal concentric contraction in both eyes. Vision in the left eye had deteriorated, and the central vision of the right eye had not changed (fig. 3).

CASE 3.—*History.*—A white man, aged 25, a waiter, born in Scotland, on Nov. 15, 1932, was admitted by Dr. Hyland to the neurologic service for observation. The patient complained of poor vision for four months; before this he had been well except for scarlet fever at the age of 5 years. He had been in the army. He stumbled over obstacles on the ground. Three days previously his head had been injured by collision with an open door, and the wound had required two stitches. The following day he had violent frontal headaches of a pounding

type. Dizziness was noticed the day before admission, and the patient believed that his sight was worse after the injury.

Family History.—The patient's father and mother and four sisters were alive and well; one sister had a squint which was corrected by glasses; one brother was alive and well; one brother had died at 18 months of age. There was no history of miscarriages or stillbirths. Months later, a letter from the patient's father in Scotland revealed that one sister had a condition which had been diagnosed as retinitis pigmentosa by a specialist in Aberdeen.

General Examination.—Examination of the respiratory, cardiovascular, gastrointestinal, genito-urinary and nervous systems and of the skin and extremities showed nothing of interest in addition to the ocular symptoms.

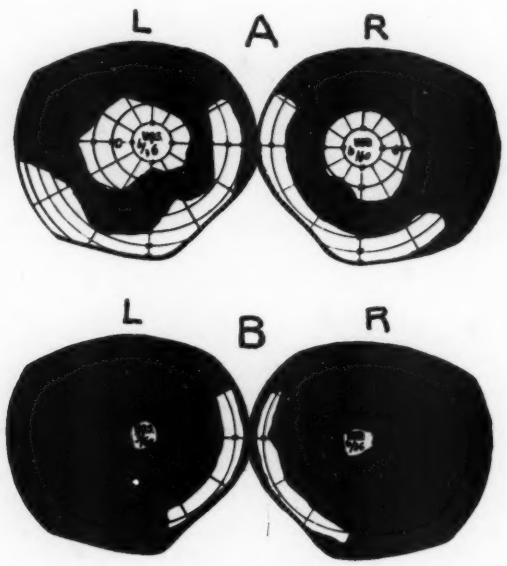

Fig. 3 (case 2).—*A*, fields on Aug. 24, 1931, before operation, taken with a 10 mm. test object. Vision was 6/36 in the left eye and 6/60 in the right. *B*, fields on Oct. 3, 1933, two years after operation, taken with a 10 mm. white test object at 1 meter. Vision was 3/60 in the left eye and 6/36 in the right.

Ophthalmic Examination.—Vision in the right eye was 6/24, and that in the left, 6/12. The patient read well, had few headaches and had never worn glasses. There was no blood relationship of the parent or grandparents. The patient could not see well at night. The pupils were sluggish (and reacted to light and in convergence and consensually); the other ocular movements were normal. He had low hypermetropic astigmatism. The fundus of the right eye showed a clear lens, numerous vitreous opacities, one of which was large, and a marked temporal crescent. The choroidal vessels were numerous; the macula and grounds showed marked stippling and heavy deposits of bone corpuscle type, which in places covered the vessels. The left eye showed fewer vitreous opacities, but otherwise was similar to the right eye. The fields of vision before operation showed a complete ring scotoma to a 10 mm. white object. Following removal of the right stellate ganglion the clear central field was slightly larger. The left field showed no change.

Laboratory Examination.—The Wassermann reaction was negative; urinalysis showed nothing of interest. A blood count showed 92 per cent hemoglobin and 8,300 white cells, with 71 per cent neutrophils and 25 per cent lymphocytes. The Wassermann and Kahn reactions of the spinal fluid were negative and there was no increase in globulin. Dental examination showed slight caries, and a full upper denture, following extraction four years before.

Operation and Subsequent Course.—On November 22 the right stellate and second thoracic ganglions were removed.

On November 23 the right pupil was constricted. On December 10 the patient thought that vision was improved, but we found no change in the right field. On Sept. 25, 1933, the patient stated that he noted no change in vision. He noticed that the right hand did not perspire; there was no change in the temperature of

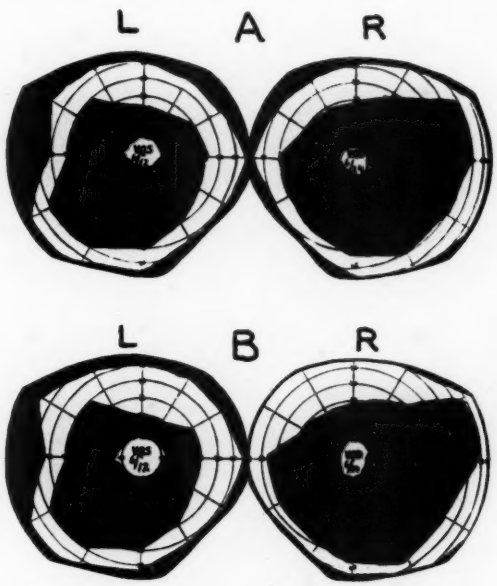

Fig. 4 (case 3).—*A*, fields on Nov. 17, 1932, before operation, taken with a 10 mm. test object. Vision was 6/36 in the left eye and 6/60 in the right. *B*, fields on Dec. 8, 1933, one year after operation, taken with a 10 mm. white test object. Vision was 6/12 in the left eye and 6/24 in the right.

the hands in cold water and no change in sensation in the right hand and arm or in the face. Examination showed the right pupil to be slightly smaller than the left; the right hand was dry, but was cooler than the left. There had been no headaches since operation. The fields are shown in figure 4.

CASE 4.—*History.*—H. D., a white man, aged 24, a carpenter, was admitted from the outpatient department on March 23, 1933, and discharged on April 19. On admission his chief complaint was dimness of vision for a long time. At school he had had to sit in the front row. His eyes used to tire readily. He had never worn glasses, but noticed that his sight was poor in the dark. He saw well in bright light. On account of his poor night vision he did not go to unfamiliar places after dark. Otherwise, he had been well all his life. He had a brother, ten years older, with similar symptoms, who was blind.

General Examination.—There was no headache, dizziness or other positive symptoms. The patient was well developed and well nourished.

Ophthalmic Examination.—The pupils were equal; the fundi showed opacities of the posterior part of the lens and numerous vitreous opacities. The disks were pale temporally; the arteries were small, and there were many deposits of pigment of the bone corpuscle type. Examination of the left eye showed a similar condition. Refraction showed moderate astigmatism in the right eye and rather more in the left. The ocular movements were free in all directions; there was no nystagmus.

Operation and Subsequent Course.—On March 31 the right stellate and second thoracic ganglions were removed. On April 1, following the operation, the patient had a moderate amount of pain in the right side of the neck and the right shoulder.

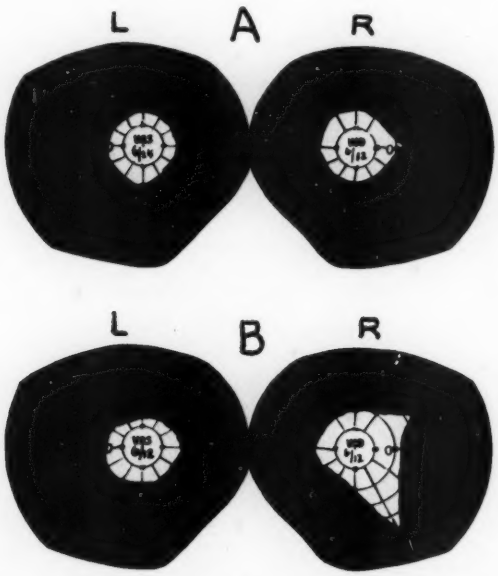

Fig. 5 (case 4).—*A*, fields on March 1, 1933, before operation. The peripheral fields were taken with a 10 mm. test object. The central field of the left eye was taken with a 5 mm. blue test object, a 1 mm. red test object and a 1 mm. green test object. The central field of the right eye was taken with 5 mm. blue, red and green test objects. Light was good. Vision was 6/24 in the left eye and 6/12 in the right. *B*, fields on September 14, six months after operation, taken with a 10 mm. test object. Cooperation was good. Light was dull. Vision was 6/12 in each eye.

The right arm was warmer than the left; the right pupil was contracted, and there was slight ptosis of the right upper eyelid.

On April 7 the stitches were removed. The wound was clean. The right pupil was still smaller than the left; there was less ptosis.

On April 15 the ptosis of the right eye had disappeared, and the right pupil was smaller.

On April 19 the patient said that vision was slightly improved, but there was no apparent change in the fundus, and the right pupil was contracted (fig. 5).

Laboratory Examination.—A blood count showed 65 per cent hemoglobin, and 9,800 white cells. The Wassermann reaction of the blood was negative.

Subsequent Course.—The patient returned to the outpatient department on September 14. The field of the right eye showed definite extension temporally and down. Vision was 6/12. On October 12 the right pupil was smaller than the left; the patient saw better when looking to the right. He returned to work, which he had to give up two years before. On Feb. 1, 1934, the tonometer showed less Schiötz tension in the right eye than in the left. The patient had an island of vision in the right temporal field measuring 10 by 30 degrees.

PATHOLOGIC CONSIDERATIONS

Pathologic investigations into the etiology of retinitis pigmentosa have been few and usually have been carried on late in the course of the disease, when some other serious disease was present, and there is no satisfactory information in regard to early changes.

Collins,[21] Koyanagi [22] and Verhoeff [23] expressed the belief that vascular factors are not primarily responsible for this condition.

Parsons,[24] with the majority of authorities, stated the belief that choroidal vascular changes produce the retinal condition seen in retinitis pigmentosa. The anastomosis of the recurrent ciliary arteries with the posterior (short) ciliary arteries occurs at the region of the equator; hence slowing of the circulation at this point may allow toxic action or interfere with the nutrition of the rods. It is usual for a toxin to injure the more highly specialized cones, and so it seems possible that some other factor is responsible. The results of ophthalmoscopic examination and charts of the fields of vision confirm the fact that this area is the first part involved. One of us has observed that the corneal capillary loops show marked slowing of the circulation, which is demonstrable with the biomicroscope. Also the retinal arteries are small in every patient whom we have seen suffering from retinitis pigmentosa. Our attempts to follow in experimental animals a change in the caliber of the retinal vessels after sympathectomy were unsuccessful, owing to the fact that small changes of the order of 10 microns cannot be measured with a grid ophthalmoscope. It is our impression, however, that there is an immediate increase.

Pearson and Bell,[25] with Nettleship's assistance, have published a mass of information that every one interested in retinitis pigmentosa should read. It is stated therein that few family trees giving histories of

21. Collins, T.: Tr. Ophth. Soc. U. Kingdom **39**:165, 1919.

22. Koyanagi, Y.: Arch. f. Ophth. **127**:1, 1931.

23. Verhoeff, F. H.: Microscopic Observations in a Case of Retinitis Pigmentosa, Arch. Ophth. **5**:392 (March) 1931.

24. Parsons, J. H.: The Pathology of the Eye, New York, G. P. Putnam's Sons, 1904, vol. 2, p. 602; 1906, vol. 4, p. 1396.

25. Pearson, K., and Bell, Julia: Treasury of Human Inheritance, London, Cambridge University Press, 1922, vol. 21.

this condition have been reported in America. It is worthy of note that in two of our cases the families came from England, where relatives affected with this condition are living. The father of one patient disclaimed any history of familial ocular trouble, but it was found that a sister had seen an oculist in Aberdeen and the condition was diagnosed as retinitis pigmentosa with marked pigmentary changes. A history of these families has been difficult to obtain and is still incomplete, in spite of repeated communication with British hospitals and the relatives concerned.

ANATOMIC, PHYSIOLOGIC AND SURGICAL CONSIDERATIONS

It is now well established that interruption of the sympathetic fibers to the vessels of the upper or lower limbs in man brings about an increase in

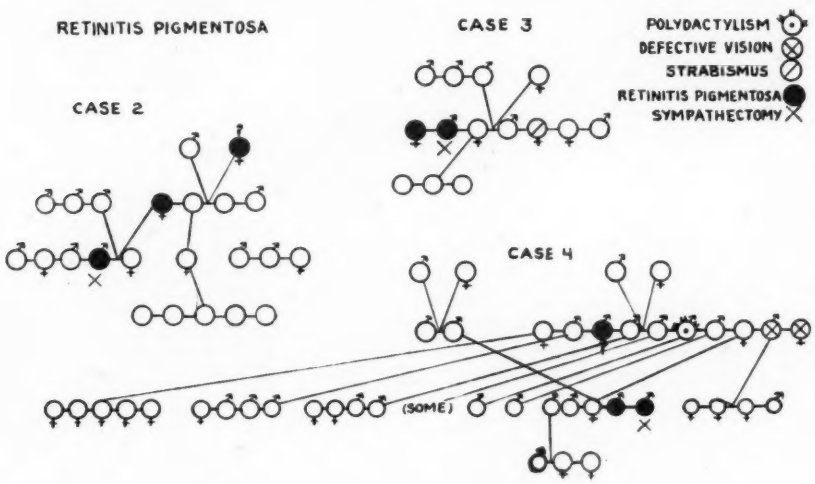

Fig. 6.—Genealogy for cases 2, 3 and 4.

the circulation of the blood to the part affected by the operation. It has been assumed that the same result will be obtained if the sympathetic supply to the choroidal vessels is interrupted. There are some interesting clinical reports substantiating the view that the ocular vessels are capable of spasm. One of the most interesting and convincing cases is that reported by Davenport.[26] This author observed the retinal arteries during several temporary attacks of partial and complete blindness. In all attacks the appearances were similar—

> . . . a fixed, dilated pupil, a very pale optic disc, the arteries so narrowed as to be hard to trace a little way off the optic disc, and the blood-column in the veins broken up, the segment of blood moving jerkily in different directions in various parts of the system. As the attack passed, the arteries filled in a moment, and the

26. Davenport: Tr. Ophth. Soc. U. Kingdom **51**:115, 1931.

blood-column rapidly restored the veins. Vision was fully regained in a few seconds after the circulation.

It is a relatively simple matter to resect the superior and middle cervical ganglions in the neck. The probabilities are that such a procedure interrupts most of the sympathetic fibers supplying the choroidal vessels, but it is possible that fibers join the carotid plexus below the site of operation, and thus the maximum effect is not obtained. To overcome this, it has been suggested that this operation might be combined with stripping of the carotid artery, thus interrupting the fibers in the carotid plexus. In the four cases in our series the sympathetic trunk was exposed from behind by removing part of the second rib or of the second and first ribs. In case 1 the trunk was divided below the second thoracic ganglion, as advocated by Royle. He believed that such a procedure would interrupt most of the fibers; it is obvious, however, that by this method the upper fibers leaving the cord by way of the eighth cervical and first thoracic nerves escape section. In our other cases the trunk was divided below the second thoracic ganglion, and the stellate ganglion and intervening portion of the trunk were removed. We think that the removal of the stellate ganglion was particularly complete in case 4. In the remaining two cases it is possible that only part of the stellate ganglion was removed. From experience gained in operating on these four patients, it is our conviction that it is necessary to remove part of the first and second ribs to obtain adequate exposure and to insure removal of the stellate ganglion along with the sympathetic fibers which leave the cord by way of the eighth cervical and first thoracic nerves. Such a procedure properly carried out would completely interrupt all the sympathetic fibers which reach the choroidal vessels, if our anatomic basis is sound, and no sympathetic fibers leave the cord above the eighth cervical nerve. The operation, however, has the distinct disadvantage of being a formidable procedure and causes the patient discomfort and pain in the shoulder for some time afterward.

The following observation by Claude Bernard [27] is significant:

If the cervical sympathetic of the rabbit is divided, the blood vessels of the ear become dilated, but after a time they recover their tone; this is due to the nerve cells in the superior cervical ganglion exercising a 'local vaso-motor control'; if, however, the superior cervical ganglion is excised, the arterioles of the ear remain permanently dilated.

One of us (K. G. McKenzie) has come to the conclusion that resection of the superior and middle cervical ganglions, along with sympathectomy of the pericarotid nerves, is preferable to section of the trunk

27. Bernard, Claude, in Lyle, H. W., and DeSouza, D.: Manual of Physiology, ed. 2, London, H. Frowde; Hodder & Stoughton, 1921, p. 240.

below the stellate ganglion or removal of the stellate ganglion itself. There are two important reasons for this:

A. Technically it is a simpler procedure and a safer and easier operation for the patient to undergo.

B. In view of the observation by Claude Bernard, it would seem important and perhaps necessary, to remove the superior cervical ganglion to obtain permanent dilatation of the choroidal vessels.

SUMMARY OF RESULTS

Royle,[1] Campbell [18] and Meighen [19] reported much greater success than we had in our series.

Our four patients made an uneventful recovery, with an average of twenty-three and one-half days in the hospital, and showed (except the patient in case 1) Horner's syndrome on the right side following the operation, with a small pupil, slight ptosis and enophthalmos.

In regard to sympathectomy, our patients were told frankly that, although the operation was well known and had long been used, its application to their condition was new and more or less experimental.

They were all intelligent and well aware of the poor prognosis.

The patient in case 1, aged 45, was the oldest, and gave a history that indicated more than fifteen years of serious defect in vision, with only a microscopic central fixation field at the time of operation. Following operation no benefit could be demonstrated.

The patient in case 2, 24 years of age, gave a history that indicated an obvious defect at the age of 7. Both fields were smaller after operation, the right decreasing possibly less than the left, and the operation in this case must be classed with that in case 1 as a failure.

In the patient in case 3, 25 years old, it is certain that the changes in the fundus and the large ring scotoma indicate a longer duration of ocular trouble than was suggested by the short history that he gave. The field was definitely increased on the side on which the operation was performed.

The patient in case 4, 25 years of age, with a history of ocular disorder for eighteen years, seemed unduly encouraged with the small temporal field that we could demonstrate as a result of operation. The fact that his older brother is blind may have had a psychologic influence in leading him to give up his work too early.

CONCLUSIONS

1. Four patients with retinitis pigmentosa were treated by sympathectomy. There was regression in one, which was possibly less on the side on which the operation was performed; there was no improvement in one; two showed slight improvement, which was more marked in the

patient with the shortest history of retinitis pigmentosa, although he had marked pigmentary changes in the retina.

2. The experience in case 3 suggests that better results are obtained if operation is performed earlier in the course of the disease. In a recent personal communication, Dr. H. Kerr [28] of Washington, D. C., informed us that he obtained striking improvement in two early cases with fairly full fields.

3. Earlier cases should be obtained for operation by keeping in close touch with the relatives of known patients. Their cooperation in constructing a family tree impresses on them the hereditary nature of the disease and the possibility and importance of early treatment.

4. The operative treatment has been outlined, and it is suggested on the basis of Claude Bernard's observations that removal of the superior cervical ganglion may be more efficacious than removal of the stellate ganglion or section of the sympathetic trunk below the stellate ganglion. Either of the latter two procedures was employed for treatment in the cases reported in this article.

5. The operation was performed on only one side (the right) in each of our four patients. One side (the left) was deliberately left as a control. It is our hope that the advancing loss of vision will be held in check on the side on which the operation was performed. If this should prove to be the case, the major operative procedure carried out on these four patients will have been fully justified. Sympathectomy may be of value in later stages of the disease, but this is a question that only time will answer.

---

28. Kerr, H.: Personal communication to the authors.

ESSENTIAL SHRINKAGE OF CONJUNCTIVA IN A CASE OF PROBABLE EPIDERMOLYSIS BULLOSA DYSTROPHICA

MARTIN COHEN, M.D.
AND
MARION B. SULZBERGER, M.D.
NEW YORK

The following report is of a case of uncommon ophthalmologic and dermatologic lesions. Both the ocular and the cutaneous disease are so rare in themselves that the combination presented by our patient seems to form a morbid entity worthy of record.

The ocular lesions which we are about to describe are generally called ocular pemphigus or essential shrinkage of the conjunctiva. These lesions, as is well known, may appear alone, without a cutaneous or other pathologic condition, or they may occur in association with pemphigus vulgaris.

In addition to this well known combination of pemphigus of the eye and the skin, identical ocular lesions may also, though rarely, be combined with, or form a part of, certain other dermatoses.

Rigler, Lipp, Fuchs, Duhring, Dikran Bey and others, cited by Tachau,[1] and also Barkan,[2] Hartley,[3] Stevens and Johnson,[4] and Bailey[5] have described ocular lesions of the pemphigus type associated with erythema exudativum multiforme (Hebra).

Read at the Seventieth Annual Meeting of the American Ophthalmological Society, Lucerne, Canada, July 9, 1934.

From the Department of Ophthalmology and the Department of Dermatology and Syphilology of the New York Post-Graduate Medical School and Hospital of Columbia University.

1. Tachau, P., in Jadassohn, J.: Handbuch der Haut- und Geschlechtskrankheiten, Berlin, Julius Springer, 1928, vol. 6, pt. 2, p. 598.

2. Barkan, H.: Herpes Iris of the Conjunctiva, Arch. Ophth. **42**:236, 1913.

3. Hartley, C. C.: Erythema multiforme exudativum, in Schieck, F., and Brückner, A.: Kurzes Handbuch der Ophthalmologie, Berlin, Julius Springer, 1931, vol. 4, p. 154.

4. Stevens, A. M., and Johnson, F. C.: A New Eruptive Fever Associated with Stomatitis and Ophthalmia, Am. J. Dis. Child. **24**:526 (Dec.) 1922.

5. Bailey, J. H.: Lesions of the Cornea and Conjunctiva in Erythema Exudativum Multiforme (Hebra), Arch. Ophth. **6**:362 (Aug.) 1931.

In cases of Duhring's disease (dermatitis herpetiformis) the eyes have occasionally been similarly involved.[6]

Although all the mentioned combinations are known to be infrequent, the combination of pemphigus-like lesions of the eye with epidermolysis bullosa is so unusual that we could find but few pertinent references in the ophthalmologic and the dermatologic literature.[7]

The dermatologic condition in our patient was not characteristic of epidermolysis bullosa in every respect, being in some ways suggestive of erythema multiforme and of dermatitis herpetiformis (see analogies with case reported by Bogrow).[7a] However, after mature study and lengthy investigations, we concluded, as did Bogrow, that we were dealing with a case of atypical epidermolysis bullosa associated with essential shrinkage of the conjunctiva. We are, therefore, submitting the report of this rare combination.

In this report we wish expressly to avoid the many as yet moot points regarding the etiology and pathogenesis of epidermolysis bullosa and the sometimes bafflingly similar bullous pemphigus, as well as the question of the relationship or differentiation of epidermolysis bullosa hereditaria simplex, epidermolysis bullosa hereditaria dystrophica and epidermolysis bullosa dystrophica acquisita. According to the recent criteria of classification of Siemens,[8] we are inclined to place our case in the last category.

REPORT OF A CASE

History.—Robert L., aged 7 years, the American-born son of Swedish parents, was first seen in the Dermatologic Clinic and in the Ophthalmologic Department of the New York Post-Graduate Medical School and Hospital on Oct. 24, 1932.

The patient's mother was said to have had a positive Wassermann reaction of the blood about ten years before (1922), i. e., three years before his birth, at which

6. Lutz, W.: Dermatitis herpetiformis (Duhring), in Schieck, F., and Brückner, A.: Kurzes Handbuch der Ophthalmologie, Berlin, Julius Springer, 1932, vol. 7, p. 132. Riecke, E., in Jadassohn, J.: Handbuch der Haut- und Geschlechtskrankheiten, Berlin, Julius Springer, 1931, vol. 7, pt. 2, pp. 247, 578 and 596.

7. (*a*) Bogrow, S.: Zur Kenntnis der atypischen bullösen Hautaffektionen, Arch. f. Dermat. u. Syph. **110**:75, 1911. (*b*) de Schweinitz, G. E.: A Case of Epidermolysis Bullosa with Ocular Lesions, Tr. College Physicians, Philadelphia **35**:417, 1913. (*c*) Tobias, N.: Lesions of the Mucous Membranes in Epidermolysis Bullosa, Arch. Dermat. & Syph. **18**:224 (Aug.) 1928. (*d*) Lutz, W.: Epidermolysis bullosa traumatica hereditaria, in Schieck, F., and Brückner, A.: Kurzes Handbuch der Ophthalmologie, Berlin, Julius Springer, 1932, vol. 7, p. 304.

8. Siemens, H. W.: Ueber die Differentialdiagnose der mechanisch bedingten Blasenausschläge mit Beiträgen zur Kasuistik der sog. Epidermolysis bullosa, Arch. f. Dermat. u. Syph. **139**:80, 1922; Zur klinischen und histologischen Kenntnis einer nichterblichen Form der sogennanten Epidermolysis: Bullosis mechanica toxica ex Usu Arseni, ibid. **149**:71, 1925.

time she received antisyphilitic treatment. Repeated Wassermann tests of the blood of the mother at our clinic elicited negative reactions, but the reactions to the Kahn tests were positive. The patient was one of seven children; the six others were said to be alive and healthy and to be without cutaneous or other diseases. According to her statement, the mother had no miscarriages and no stillbirths either before or after the birth of the patient. The father was apparently in good health; a Wassermann test of the blood was not made. There was no consanguinity in the parents.

The patient was born at full term and developed normally. Dentition was normal. There was a history of mumps, measles and chickenpox, but no other diseases of childhood. The results of the physical examination were negative. The mother noticed an eruption of the skin and "sore eyes" four years before the date of the patient's admission to the hospital; the former was described by her as consisting of papules and vesicles ("bumps and blisters"). While the skin never became entirely clear, the dermatosis was generally worse during the summer.

The family moved from Chicago to New York in July 1932. On April 27, 1932, the Wassermann reaction of the child's spinal fluid was reported to be positive, while the Wassermann reaction of the blood was negative. From April 28 to July 2, he received six injections of neoarsphenamine (average dose, 0.3 Gm.), nine injections of mercuric salicylate (total of 8 cc.) and three injections of thiobismol.

After arriving in New York, from July 3 to September 10, the patient received three antisyphilitic injections from a private physician (remedy used unknown).

During the entire period of antisyphilitic treatment, the cutaneous and other manifestations (all of which had appeared before the instigation of this treatment) continued to become progressively worse, and the mother brought the child to our dermatologic clinic.

Physical Examination.—The boy was of normal height. He was pale and thin and seemed dazed and apathetic. The right eye was reddened and swollen; there were tearing, seropurulent discharge and photophobia. There were no stigmas of congenital syphilis, the teeth, bones, etc., being normal. On the forehead, cheeks and neck were scattered lesions of three distinct types: (1) irregularly distributed, somewhat succulent, approximately round, lentil-sized papules, with a tendency to central exudation, excoriation, crusting and bleeding; (2) larger lesions, a few on the face and a greater number on the sides and back of the neck, having the appearance of a small urtica or else showing the typical cockade arrangement frequently seen in erythema multiforme, and (3) true vesicles and small bullae, appearing isolated on normal or slightly scaly and erythematous skin. These varied in size from that of a pinhead to that of a small pea and were irregularly scattered on the nose, chin, eyelids, etc.

The ears presented lesions of a different sort. In addition to the small vesicles found elsewhere, there was clinically atrophy of the skin of the edges of the helixes. Interspersed in this atrophic skin were a few fairly sharply circumscribed, yellowish-white and roughly round maculopapules varying in size from that of a pinpoint to that of a pinhead. Some of these were slightly above the level of the skin; others could be seen shimmering through the thin epidermis. The consistency of these lesions varied from hard to hard-elastic (pseudomilia, epidermal cysts).

Scattered over the arms, trunk, buttocks, thighs and legs were sparse lesions of the papulovesicular type and some of the cockade form.

The extensor surfaces of the elbows presented palm-sized patches of fairly sharply circumscribed atrophic or pseudo-atrophic skin. The palms and soles were covered with a reddened, dry, apparently atrophic and finely lined but tight skin. On the palms, the atrophy stopped with a sharply outlined circinate margin toward the wrists and the midportions (fig. 2). The soles presented atrophy of the skin with some hyperkeratosis, dryness and scaling, as well as erythema. In all the atrophic areas, namely, on the ears, on the extensor surfaces of the knees and elbows and on the palms and wrists, the whitish-yellow structures of epidermal cysts, previously described as occurring on the ears, were also present. On the

Fig. 1.—Note the cutaneous lesions on the face, the bullae on the left upper lid and the secretion covering the eyelids.

flexor surface of the right wrist and on the left thumb, these small, hard-elastic tumors were grouped to form larger annular or irregularly shaped lesions.

All the nails were normal except for a slight degree of onychogryphosis on the right great toe.

The mucous membranes were also the seat of occasional lesions. The transitional mucosae of the mouth and of the nares presented a few blebs. There was a superficially ulcerating proctitis with evidences of contractile scarring. A few superficial defects of oval shape and approximately lentil-sized, apparently the seats of ruptured bullae, were found on the mucous membrane of the hard and soft palate. The lesions of the conjunctivae and eyes will be described in detail later.

Histologic Examination.—For the purposes of study two specimens were taken for biopsy. One was from a clinically normal piece of skin from the abdomen, and

the other, from an area of skin on the right arm occupied by a group of bullae. The observations, as reported by Dr. Satenstein, were as follows:

In the clinically normal specimen (fig. 3) the elastic tissue was disorganized. The lower portion of the cutis was granular and fragmented; in this deeper portion there was an apparent increase in the number of elastic fibers, and these seemed to be more closely packed, running more than usually parallel to the surface of the

Fig. 2.—Note the thin, dry, apparently atrophic epidermis and the group of milia on the ulnar side of the right wrist and on the left thumb.

skin. In the pars papillaris there was an apparent total absence of elastic tissue fibers (Weigert stain).

The specimen from the lesion (fig. 4) showed fragmented and altered elastic tissue fibers, as in the normal specimen. In the pars papillaris the elastic tissue was, for the greater part, absent. In this specimen there was noted the development of some edema in the upper portion of the cutis and of a slit forming

between the basal cell layer of the epidermis and the underlying cutis (Weigert stain). Both of these changes were characteristic of epidermolysis bullosa dystrophica.[9] This was true to such a degree that we believed it possible to rule out, on histologic grounds alone, the diagnoses which had previously been entertained, namely, erythema exudativum multiforme, dermatitis herpetiformis, pemphigus vulgaris and drug eruption.

Fig. 3.—Histologic picture of clinically normal skin (Weigert's elastic tissue stain). Note the absence of elastic fibers in the upper portions of the cutis and their degeneration in the lower portions. This is considered characteristic of epidermolysis bullosa.

Course.—The course of the cutaneous disease was chronic, with intermittent ameliorations and exacerbations. A summary of the results of various investigative procedures, carried out between Oct. 24, 1932, and the time this report was

9. Engman, M. F., and Mook, W. H.: A Further Contribution to the Study of Elastic Tissue in Epidermolysis Bullosa, J. Cutan. Dis. **28**:275, 1925.

Fig. 4.—Histologic picture of a lesion from the arm (Weigert's elastic tissue stain). Note the absence of elastic fibers in the upper portion of the cutis and their degeneration and clumping in the lower portions; also the vesicle forming by fissure between the epidermis and the connective tissue (arrow). (Compare this with the histologic picture of the conjunctiva in figure 12.)

prepared, during which time the patient was hospitalized for four different periods ranging from two weeks to two months, is as follows:

The Wassermann test, Kline exclusion and diagnostic test and quantitative Kahn precipitation test were repeatedly negative, even after the provocative administration of neoarsphenamine. The spinal fluid was normal. The blood counts and differential counts were normal. There was no eosinophilia. The bullae were found to be sterile and contained no eosinophilic cells. A complete chemical examination of the blood gave negative results. The toxicity test of the blood, performed by Dr. Pels and Dr. Macht, was negative for pemphigus.

Traumatic bullae could be produced on two occasions by the technic of Siemens;[8] at other times this test was found to give negative results.

Various remedies were tried, such as the administration of vitamins and iodides, the injection of bismuth, liver extract and neoarsphenamine; the last named medicament was the only remedy which seemed to bring about an improvement in the cutaneous and in the general condition.

An interesting observation, but one which requires further study and which we cannot here interpret, was that the administration of iodides by mouth (10 drops of a saturated solution of potassium iodide three times daily for three days) seemed to cause a rapid exacerbation of the dermatosis and perhaps also of the ocular lesions. In addition to the appearance of new crops of bullae, a generalized erythema multiforme-like eruption broke out (fig. 5). At this period, patch tests with bromide and iodide (25 per cent potassium iodide or 25 per cent potassium bromide in hydrous wool fat and petrolatum) produced a crop of bullous lesions on the previously unaffected areas of skin to which they had been applied (fig. 6). The tests were repeated several times at varying intervals, once more with positive results and three times without causing any irritation. We cannot decide whether the positive results of the patch tests were in response to the halogens themselves or simply to trauma. We are, however, inclined to believe the former, as the administration of iodide by mouth had, as we have said, brought on an exacerbation of the cutaneous lesions and the formation of new bullae.

Without further comment, it is necessary for us to call attention to the facts that the mother had received antisyphilitic treatment and probably iodides before the birth of this child and that during the four years prior to our first examination iodized salt had been used in the patient's household. It is, of course, impossible to state whether these findings have any bearing on the pathogenesis of the condition. Hermann[10] observed a case of epidermolysis bullosa in which iodine caused an exacerbation of the cutaneous lesions.

If iodine played a rôle in our case, we should have to classify the condition as epidermolysis bullosa acquisita toxica. Jadassohn reported cases of this condition due to iodoform, and Bloch, Siemens, Riecke and others[11] have observed cases attributable to other drugs, for example, arsenic. It is, of course, conceivable that iodine or another noxious agent reaching a particularly hypersensitive or otherwise susceptible skin elastica and other elastic tissue during either intra-uterine or extra-uterine life, may cause permanent damage and thus give rise to the particular tendency to the formation of bullae which characterizes epidermolysis bullosa.

---

10. Hermann, quoted by Riecke, E., in Jadassohn, J.: Handbuch der Haut- und Geschlechtskrankheiten, Berlin, Julius Springer, 1931, vol. 7, pt. 2, p. 287.

11. Jadassohn, J.: Handbuch der Haut- und Geschlechtskrankheiten, Berlin, Julius Springer, 1931, vol. 7, pt. 2, p. 267.

This hypothesis is somewhat contradicted in our case by the fact that the cessation of administration of iodine and the forcing of fluid plus the administration of large doses of sodium chloride did not cause an improvement.

It seems necessary to mention that another and perhaps related bullous dermatitis, namely, dermatitis herpetiformis, frequently responds with the production of

Fig. 5.—Erythema multiforme-like eruption following the ingestion of potassium iodide.

bullae both to patch tests and to internal administration of iodides and bromides.[12] Furthermore, we have recently seen a second case (this time of typical epidermolysis bullosa with a hereditary history) in which the reaction to the iodine patch test was slightly but definitely positive. This finding requires further investigation in additional cases.

12. Jadassohn, J.,[11] p. 592.

In view of the probable syphilitic history in our case, it should be mentioned that in the present state of knowledge syphilis cannot be considered the etiologic factor, for many cases of epidermolysis bullosa are without trace of syphilis.

Ophthalmologic Report.—On admission of the patient to the ophthalmologic clinic, the mother stated that for the past six months her child had complained frequently of pain about the eyes. She had noticed a swelling of the lids at times, accompanied by a stringy mucous discharge.

The right eye presented inflammatory edema of the upper lid and a seropurulent discharge; the tarsal conjunctiva was congested; several phlyctenae bordered the inner margin of the cornea, producing a pericorneal injection. The diagnosis considered at this time was phlyctenular keratoconjunctivitis. The left eye was normal, with the exception of a mild blepharoconjunctivitis.

The treatment for the right eye consisted of irrigations with boric acid solution, the instillation of 0.5 per cent atropine in oil, the administration of cod liver oil internally, the use of tinted glasses and instructions with regard to hygiene and

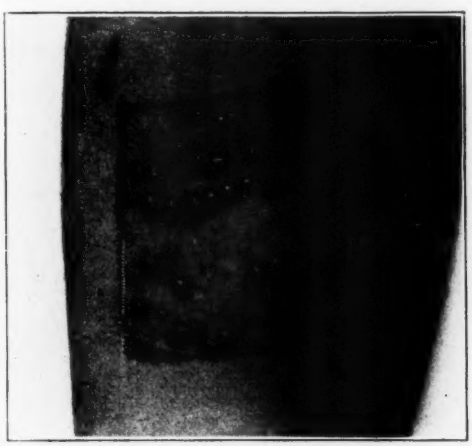

Fig. 6.—Bullous reaction to a patch test with 25 per cent potassium iodide.

diet. This eye did not improve; the cornea gradually became cloudy, owing to minute infiltrates, vesicles and bullae (fig. 7).

The left eye, after irrigations with boric acid solution, showed slight improvement.

Several months later fresh crops of vesicles appeared on the right eye and on the skin, necessitating hospitalization. The lids were edematous and red; the tarsal conjunctiva was mildly congested, had a violaceous appearance and was covered with a thin pseudomembrane; several dilated blood vessels were seen on the ocular conjunctiva. The lower culdesac was moderately shallow. Bands of tissue were seen connecting the fornix with the globe, producing a posterior symblepharon; this clinical appearance of the culdesac resembled essential shrinkage of the conjunctiva, or so-called pemphigus; it also simulated the appearance of trachoma in its cicatricial stage. The cornea became cloudy, owing to fresh vesicles and the presence of a large oval area of degenerative pannus resembling a marantic ulcer.

The left eye remained normal except for a mild conjunctival atrophy. Instillation of olive oil daily was prescribed for this eye.

For the right eye the original treatment was continued, as it was considered that any change might increase conjunctival cicatrization. After a month's stay in the hospital, the improvement in the eyes and general condition was such that the patient was discharged.

The condition of the conjunctiva of both eyes remained stationary for several months, and the corneal ulcer of the right eye assumed a brownish appearance and showed evidence of epitheliation. The child then absented himself from the clinic for about three months, and on his return an acute exacerbation was present.

In the right eye the lids were edematous; the lower tarsal conjunctiva had an atrophic or whitish color; the upper tarsal conjunctiva showed a diffuse pallor and linear scars. The lower culdesac was practically obliterated. The corneal ulcer appeared to progress superficially, as well as to penetrate into the parenchyma. The remaining portion of the cornea showed many infiltrates.

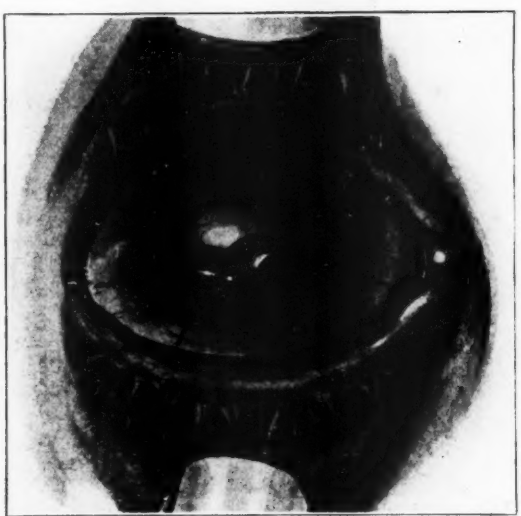

Fig. 8.—Appearance of the right eye on Jan. 19, 1934. Note the granuloma on the cornea, with obliteration of the culdesac.

In the left eye, the conjunctiva appeared pale and atrophic, and posterior symblepharon of the lower fornix was present. The cornea remained normal.

After two weeks, these ocular manifestations gradually subsided, but later marked progressive changes appeared in the ocular lesions.

In the right eye, the edema of the lids retrogressed; the entire conjunctival sac appeared pale and atrophic; the lower culdesac was obliterated; posterior symblepharon was conspicuous, and cicatricial bands were seen at the inner and outer canthi. The surface of the cornea now became gradually disorganized; its upper third was studded with small infiltrates; its lower two thirds, previously occupied by the necrotic ulcer, presented a sharply defined, elevated, yellowish-gray, vascular mass, due to chronic inflammation (fig. 8).

In the left eye, the cornea remained normal. The vision, function and fundus also remained normal, but the conjunctiva had undergone definite structural changes. The lower margin of the lid was inverted, causing a slight trichiasis which produced hyperemia of the ocular conjunctiva. The surface of the lower tarsal conjunctiva appeared pale and slightly shrunken, owing to partial atrophy

Fig. 7.—Appearance of the right eye on Dec. 27, 1932. Note the bullae and the infiltration of the cornea.

of the mucous membrane and tarsus; the lower culdesac was shallow but not obliterated; posterior symblepharon was now more marked; connective tissue bands were present at the canthi. The upper tarsal conjunctiva was pale and atrophic, showing several linear radiating scars on its upper inner surface (fig. 9).

The mild ocular treatment was continued, and epilation was performed in order to relieve the ocular irritation caused by the trichiasis.

In the right eye, the vision was gradually reduced to perception of light, the eyeball became extremely soft, and corneal perforation occurred. Enucleation was performed (Jan. 18, 1934), and the enucleated eye and a small section of the upper fornix were sent to the laboratory for examination.

The child remained in the hospital for ten days and, on discharge, showed improvement in his general condition. At the end of five weeks the conjunctival sac was still markedly congested, and its culdesac was obliterated. On May 5 there was complete ankyloblepharon.

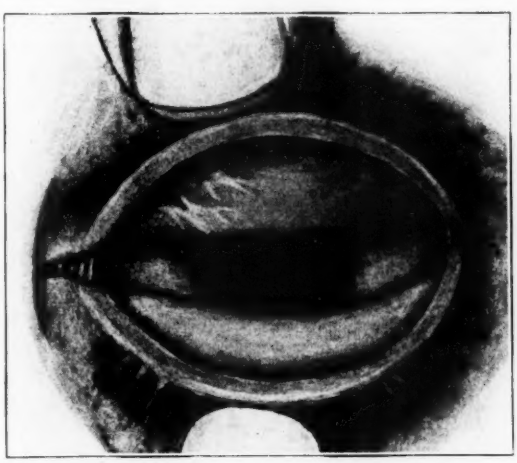

Fig. 9.—Appearance of the left eye on Jan. 22, 1934. Note the trichiasis, moderate shallow culdesac, posterior symblepharon and tissue bands at the canthi of the lower lid; on the upper lid the conjunctiva is pale and there are linear scars.

At present it is impossible to decide what future procedure, if any, can be undertaken for the restoration of the right culdesac, in order to make possible the wearing of an artificial eye. Judging from reports in other cases of essential shrinkage of the conjunctiva, transplants either from the patient or from another person are likely to be unsuccessful.

The lesions of the left eye have continued to grow progressively worse.

The slit-lamp examination of the left eye was made on May 11, at a time when the conjunctiva presented areas of cicatrization. The cornea at the periphery showed a diffuse vascularized infiltration below and nasally (fig. 10). The entire tarsal conjunctiva had a gelatinous appearance; its surface was uneven, owing to numerous elevated vesicles the size of a pinpoint and larger situated in the subepithelium, mainly near the hair line. Surrounding the vesicles were fine areas which appeared rough or denuded of epithelium. The capillaries were markedly dilated and tortuous; they wound about the vesicles and brought out a contrast between the pale and clear vesicles and the surrounding conjunctiva (fig. 11). There were several folds of connective tissue binding the tarsal and ocular conjunctiva.

Microscopic examination of the conjunctival smears showed numerous pus cells but no bacteria. The tissue of the upper conjunctival fold from the right eye was sectioned. Weigert's and Van Gieson's stains were used, not only for the purpose of studying pathologic lesions, but in order to determine the presence of possible alterations of elastic fibers in ocular structures, since this determination is of importance in the differentiation between epidermolysis bullosa and other bullous eruptions of the skin. The cells of the epithelial layer of the conjunctival fold were markedly compressed, and some of the surface epithelium was absent in areas. In a few spots there was some distinct fissuring or vesicle formation immediately beneath the epithelium (fig. 12).

There were no extraneous cells within the epithelial layer, but a few clear and granular-appearing cells were to be seen (hydrops). The underlying connective tissue was markedly edematous down to the glands, and the framework was almost

Fig. 10.—Appearance of the left eye on slit-lamp examination on May 1, 1934. Note the diffuse vascularized infiltration of the cornea below and nasally.

completely dissociated into a fine reticulum. In the subepithelial zone, there were considerable granular degeneration and numerous thin-walled blood vessels. There was a diffuse though not intense cellular infiltration of small round cells, some large connective tissue type cells and occasional plasma cells. In the deeper zones, there were a considerable amount of granulation tissue and enormously dilated thick-walled vessels. No elastic fibers were seen, except in the walls of blood vessels and around the acini of glands.

The sections of the eye were studied microscopically after staining with the same solutions used in the examination of the conjunctival sections. The cornea presented a marked keratectasia involving the greater part of its surface. It consisted of a mass of granulation tissue of chronic inflammation. This mass was made up of numerous blood vessels, lymphocytes and mononuclear and polynuclear cells. The epithelial layer and Bowman's membrane were destroyed. The parenchyma was edematous and infiltrated with lymphocytes. Descemet's membrane

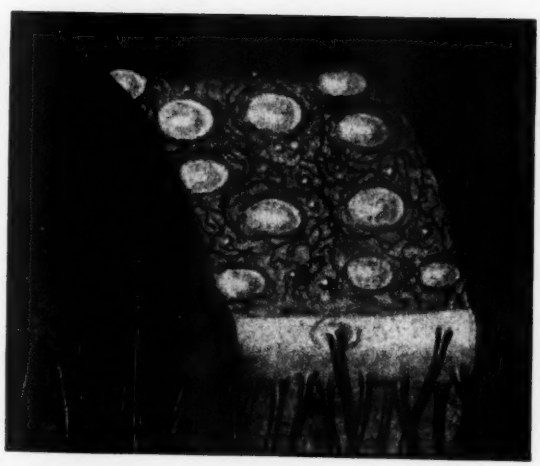

Fig. 11.—Appearance of the conjunctiva of the left lower lid on slit-lamp examination on May 1, 1934, showing subepithelial vesicles the size of a pinpoint and larger.

Fig. 12.—Histologic picture of the upper conjunctival fold of the right eye at the time of enucleation. Note the alteration in the epithelium, and the vesicle forming by fissure between the epithelium and the connective tissue, (arrow). (Compare this with the histologic picture of the cutaneous lesion in figure 4.)

Fig. 13.—Histologic picture of the lamina cribrosa of the enucleated eye in the reported case (Weigert's elastic tissue stain). Note the sparseness and fragmentation of elastic fibers as compared with those in the normal eye shown in figure 14.

was seen in folds, and a rupture in one area was caused by the lymphocytic infiltration. The iris was attached to the cornea at one spot. The anterior chamber was shallow; the iris and ciliary body showed a mild inflammatory reaction; the lens, zonular fibers and vitreous were normal. The retina and choroid showed a slight inflammatory reaction (probably due to an extension of the inflammation from the anterior portion of the eye). Elastic fibers were present in the lamina vitrea and, to a lesser extent, posteriorly surrounding the border of the optic disk. The lamina cribrosa showed sparse and fragmented elastic fibers (fig. 13) as compared with the lamina cribrosa in the normal eye (fig. 14). There were no elastic fibers visible surrounding Schlemm's canal or in the pectinate ligament.

Fig. 14.—Histologic picture of the lamina cribrosa of a normal eye (Weigert's elastic tissue stain). Note the density of the elastic tissue as compared with that shown in figure 13.

SUMMARY

Ocular lesions accompanying epidermolysis bullosa dystrophica are exceedingly rare. We found but seven cases previously recorded in the literature.

The case of a 7 year old boy with the unusual combination of atypical acquired epidermolysis bullosa dystrophica (toxica?) with ocular lesions is reported.

The cutaneous lesions were in some ways suggestive of both dermatitis herpetiformis and erythema multiforme. However, the histologic

evidence, especially the finding of the destruction of the elastic tissue both in clinically normal areas of skin and in cutaneous lesions, together with the results of other differential diagnostic procedures, led to the conclusion that the condition was atypical epidermolysis bullosa dystrophica acquisita.

The ocular lesions involved both eyes, and the acute exacerbations of the cutaneous and ocular conditions frequently occurred at about the same time. This, in addition to their clinical and histologic similarity, led to the conclusion that the ocular and cutaneous lesions were manifestations of the same underlying disease process.

The presence of phlyctenae in the early course of the ocular lesions was due to the epidermolysis bullosa (and not to an eczematous keratoconjunctivitis), and the shrinking and scarring of the conjunctiva, as well as the symblepharon, were probably the result of the tendency to vesicle formation and the atrophying and scarring processes such as are found in the cutaneous lesions of the dystrophic form of epidermolysis bullosa and such as were present in the skin in this case.

The necrotic corneal ulcer, together with the formation of granulation tissue on its surface, were probably primarily or secondarily the result of the epidermolysis bullosa in the conjunctiva or the cornea itself.

Histologically, the fissure formation between the epithelium and the connective tissue of the conjunctiva and the absence or diminution of elastic tissue fibers in the conjunctiva and in other ocular structures in which they are normally found coincide with the histologic findings in the skin in this case and in other cases of epidermolysis bullosa. More reports are necessary in order to determine the significance of these findings.

The cutaneous and ocular lesions in this case were both exaggerated by the internal administration of iodides. Furthermore, patch tests with iodides and bromides gave positive reactions twice and produced bullous eruptions. Such reactions of hypersensitivity to iodine and to bromine are frequent in cases of dermatitis herpetiformis. Hypersensitivity to iodine, to iodoform or to arsenic has been reported occasionally in cases of epidermolysis bullosa. Further study concerning the significance of such reactions is necessary.

The etiology of the described condition is unknown, the treatment inadequate and the prognosis, as far as the eye is concerned, very grave. In our case one eye had to be removed, and the other is showing a gradual increase of the pathologic process. Apparently the mildest treatment is indicated in the attempt to prevent further trauma and scarring of the conjunctiva and cornea of the remaining eye. Instillations of olive oil are being employed. Injections of neoarsphenamine

seem to have succeeded in bringing the cutaneous process to a standstill and in improving the general health of the patient. These injections are being continued.

This report is submitted in order to call attention to the grave ocular manifestations associated with epidermolysis bullosa, in the hope that further cases may be diagnosed and become the object of study. In this way more may be learned regarding this condition, and perhaps a more adequate therapy may be developed.

CYTOID BODIES

A. J. McLEAN, M.D.
PORTLAND, ORE.

Cytoid bodies have been the concern largely of ophthalmologic pathologists. They were noted almost a century ago as peculiar cell-like bodies found in the nerve fiber layer of the retina in albuminuric, traumatic or septic retinitis, in papillitis and in severe anemia. Similar bodies were also soon recognized in gliomas of the intra-orbital portion of the optic nerve.[1] Their occurrence in these tumors was particularly stressed by Verhoeff [2] in 1921, with the statement that they were "produced by the distension of a process of a neuroglia cell." The same origin was again ascribed to these structures eleven years later [3] by the same observer, who said that "they are surrounded by neuroglia cytoplasm," but that "the substance composing them is derived from red blood corpuscles which have permeated into the neuroglia syncytium [sic] and there undergone a peculiar transformation." Verhoeff also added that he had found these bodies in several cerebral gliomas, and since then on occasion has inferentially used them to determine a diagnosis of glioma.[4]

Neuropathologists have learned by scrupulous necessity that varieties of glial structure can be recognized reliably only in healthy parts of tumor tissue, and that the varied degenerations and regressive products sometimes occurring in glial tumors, striking though they are, may not be used safely as primary evidence of tumor types, nor may they ever be given an influential position in consideration of a diagnosis based on examination of tissue. This, moreover, is largely true throughout the field of general pathology; it is the anabolic stage of changes which is sought there first; catabolisms and degenerations (amyloid, hemoclastic,

---

From the Neuropathologic Section of the Department of Pathology, University of Oregon Medical School.

1. Hudson, A. C.: Primary Tumors of the Optic Nerve, Roy. London Ophth. Hosp. Rep. **18**:317, 1912, case 1.

2. Verhoeff, F. H.: Primary Intraneural Tumors (Gliomas) of the Optic Nerve: A Histologic Study of Eleven Cases, Including a Case Showing Cystic Involvement of the Optic Disc, with Demonstration of the Origin of Cytoid Bodies of the Retina and Cavernous Atrophy of the Optic Nerve, Tr. Sect. Ophth., A. M. A., 1921, p. 146.

3. Verhoeff, F. H.: Tumors of the Optic Nerve, in Penfield, W.: Cytology and Cellular Pathology of the Nervous System, New York, Paul B. Hoeber, Inc., 1932, vol. 3, sect. 21, p. 1029.

4. Kiehle, F. A.: Tumors of the Optic Nerve: Report of a Case, Tr. West. Ophth. Soc., 1934, to be published.

"fatty" and hyaline), interesting in themselves, are not characteristic of specific tissues and therefore are not used for their identification. The inferential use of cytoid bodies to determine a diagnosis of glial tumor therefore warrants careful scrutiny of its histopathologic bases.

DEFINITIONS

The following description of cytoid bodies is taken from Parsons'[5] "The Pathology of the Eye":

> The [cytoid] bodies are round, spindle-shaped, or irregular, variable in size, but often large, granular, or homogeneous, except when they contain one or more globules resembling nuclei. They are often aggregated into clusters. The nucleoid structures are central, round, or elongated, sharply contoured, highly refractile bodies. They stain more deeply than the periphery with both nuclear and diffuse stains; they are also stained darker with Weigert's medullary sheath stain, and are dark reddish brown with van Gieson. With Russell's carbol-fuchsin and iodine green stain the central bodies are bright red,[6] the periphery bluish green. These peculiar cytoid bodies were first described in albuminuric retinitis by Heymann and Zenker (1856), and were regarded as degenerated ganglion cells. This view cannot be accepted, since they occur frequently in the inner part of the [retinal] layer where there are no ganglion cells. Virchow confirmed the observation and supported the explanation. H. Müller drew attention to their uniform association with the nerve fibers, either in the retina or papilla, and regarded them as swollen, varicose, or ganglionic nerve fibers; he thought that they were characteristic of albuminuric retinitis, a view which was disproved by Roth. That they are not the ordinary form of varicose nerve fibers is shown by the fact that these occur invariably as a post-mortem condition, and do not then present the same features. . . . Litten, with whom Greeff agrees, regards the cytoid bodies as clumps of degenerated leucocytes; the latter points out that neuroglial cells are scanty in this situation, so it is improbable that they can account for the appearances; moreover, it is unlikely that they proliferate. . . .

Friedenwald,[7] in his "Pathology of the Eye," said:

> They consist of localized thickenings of the nerve fiber layer of the retina accordingly called "whirls of nerve fibers." Recent studies, however, have demon- They were first believed to be swollen nerve fibers cut on the bias and they were accordingly called "whirls of nerve fibers." Recent studies, however, have demonstrated that they are globular, not tubular, structures, and it seems clear that they are large swollen necrotic mononuclear wandering cells. . . . The lesion begins with a small hemorrhage in the nerve fiber layer, with resulting necrosis of the tissue and cellular reaction. When the accumulation of wandering cells becomes sufficiently dense, those at the center of the lesion become necrotic, and are seen

---

5. Parsons, J. H.: The Pathology of the Eye, London, Hodder & Stoughton, 1905, vol. 2.

6. Compare: "Other hyaline droplets . . . are the so-called Russel's fuchsinophile bodies, which may be found in tumors or in old granulation tissue" (MacCallum, W. G.: Textbook of Pathology, Philadelphia, W. B. Saunders Company, 1920, p. 97).

7. Friedenwald, J. S.: Pathology of the Eye, New York, The Macmillan Company, 1929.

in the sections only as faint shadows. Even in well developed cases, however, remains of red blood cells can almost always be found in the lesion. . . .

Friedenwald's photomicrographic illustration (his figure 161) shows bodies in the retina corresponding to those depicted in this article. In my figure 1 *A*, *B* and *C* are photographic reproductions of Verhoeff's [2] figures 10, 11 and 12; his description follows:

As seen in these tumors, the cytoid bodies when small are often round, and rarely encapsulated. The large ones are generally elongated and highly irregular in shape (Figs. 10 and 11), and sometimes roughly sausage shaped, seldom pyramidal. The largest may attain a cross diameter of .025 mm., and they may reach a length of 10 mm. The thickest are not usually the longest. None of the bodies contain definite nuclei, although occasionally, after alum hematoxylin staining, some resemblance to a nucleus is produced by a portion of the substance staining more deeply than the rest. These pseudonuclei never show a nuclear membrane or contain chromatin nets or nucleoli.

The bodies stain intensely in eosin, acid fuchsin, or carbolfuchsin, and under moderate magnification, they usually appear uniformly hyaline; but sometimes they consist of large hyaline balls. After Zenker's fixation, they stain intensely black in phosphotungstic acid hematoxylin, and when then seen under the oil immersion lens they always appear more or less granular. Frequently their bodies are continued into long processes, which in some instances are fairly coarse, but in others extremely delicate. . . .

From the foregoing quotations it appears that these bodies are circumscribed, globular, coryniform or polymorphous aggregations of refractile granular hyaline substance of uniform or metachromic acidophilic staining qualities, occasionally harboring blurred or ghostly basophilic inclusions suggestive of nuclei; they are from two to ten or more times the size of an average cell and are recognized as products of degeneration, but nevertheless are characteristically described as embedded among essentially healthy cells. Described eighty years ago in ophthalmologic pathology and subjected to rumination in that field since then, nevertheless "they have been generally disregarded," [2] and it is said that "general pathologists have given them little attention" [3] during this time, to the end that their significance and mode of formation are still regarded as obscure; despite this, they have now been advanced as characteristic of glia and thereby deductively espoused for the differential histologic diagnosis of tumors of the optic nerve.

DISTRIBUTION

Since cytoid bodies have been found in the nerve fiber layer of the retina, among glia cells of tumors of the optic nerve and in cerebral gliomas, it is logical to search for them in other intracranial tumors. Here they are readily observed. During cursory examination of chromophobe and of eosinophilic adenomas of the pituitary gland and of chordomas, meningiomas, pinealomas, craniopharyngiomas and heman-

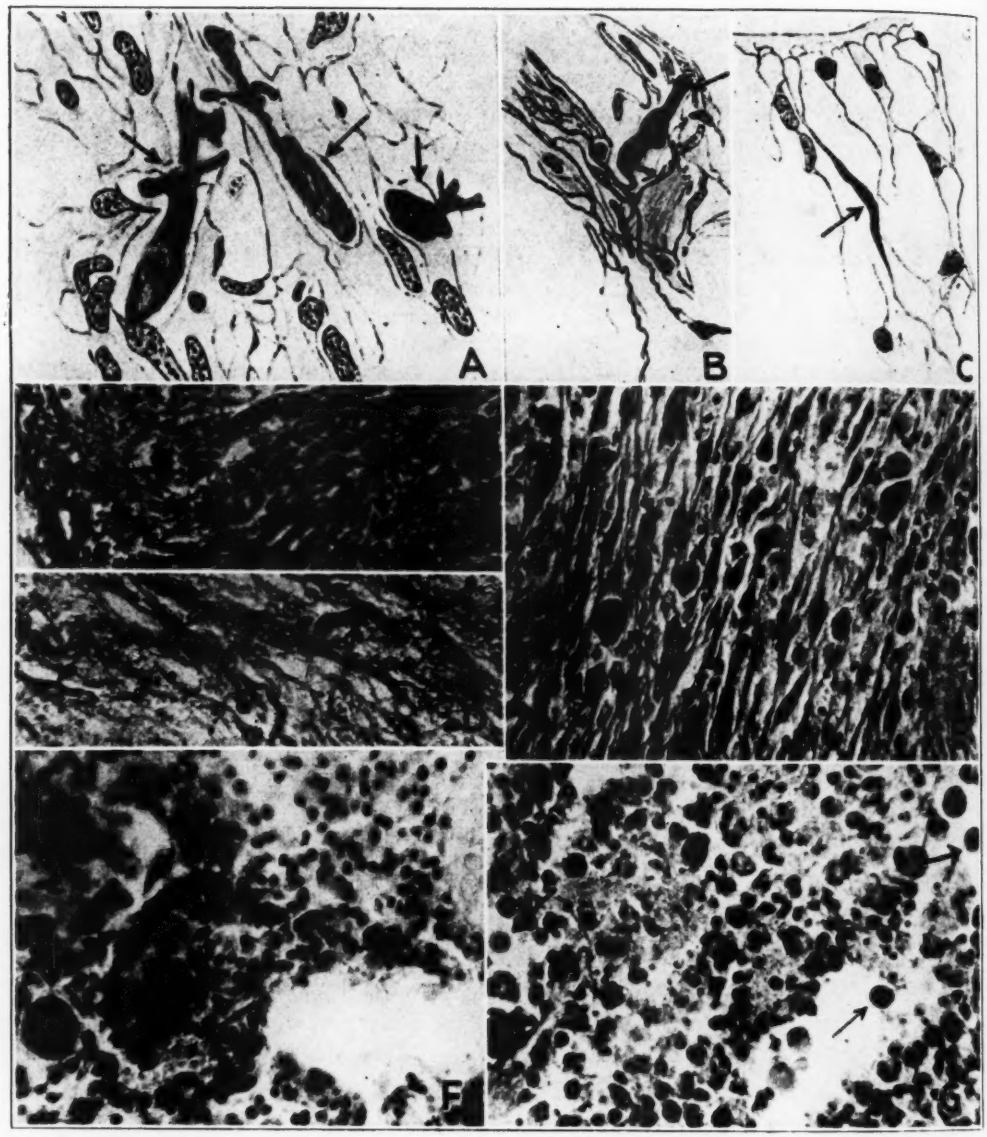

Fig. 1.—*A*, coryniform cytoid bodies in a glioma of the optic nerve, apparently hematoxylin-eosin stain and magnification of about 500 diameters. *B*, cytoid body as shown by Mallory's phosphotungstic acid stain. *C*, cytoid body in the retina. *A*, *B* and *C* are reproduced from Verhoeff.[2] *D*, glioma of the optic nerve, showing coryniform and globular forms of cytoid bodies; phosphotungstic acid stain; Kiehle's[4] case. *E*, spongioblastoma polare of the mural third ventricle, with abundant cytoid bodies. *F*, chromophobe adenoma of the pituitary body, showing exuberant growth in a healthy area. *G*, eosinophilic adenoma of the pituitary, with tissue invading the sphenoid sinus. Note the lack of normal architecture of the pituitary and the healthy tumor tissue. (All the photomicrographs except *A* to *C* are at a uniform magnification of about 140 diameters.)

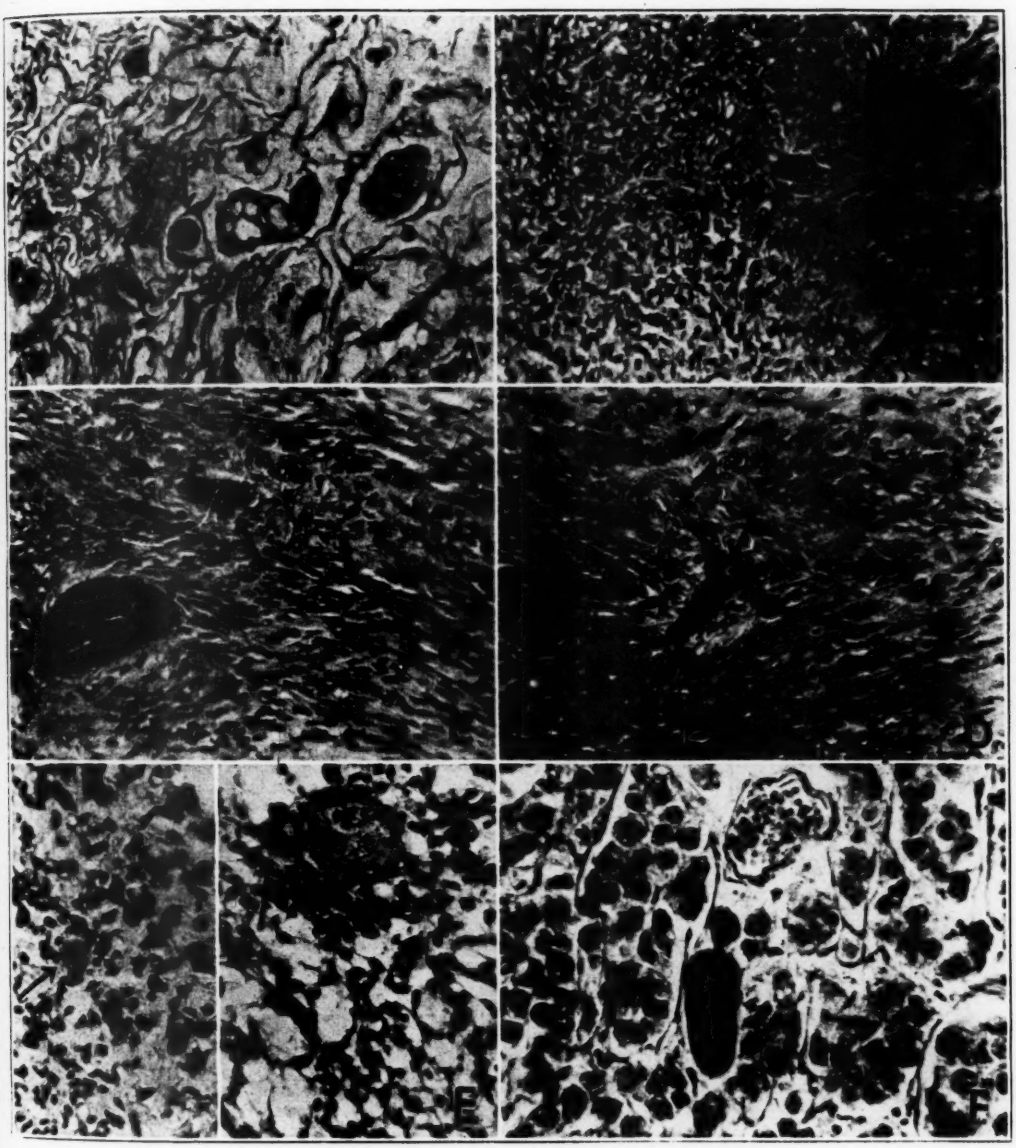

Fig. 2.—*A,* chordoma of the clivus, showing a physaliphorous nucleus and a cytoid body. *B* to *D,* nodular meningioma of the tentorial incisure. *E,* soft exuberant meningioma of the falx. *F,* pinealoma. All photomicrographs are of uniform magnification of about 140 diameters.

gioblastomas, one can find ready evidence of cytoid bodies in all these neoplasms, as shown in figures 1 *F* to 3 *C*. The question naturally arises whether these structures are confined to neoplasms and whether they are peculiar only to intracranial pathologic conditions. My continuance of the survey showed them in cerebral gummas and in cerebral abscess capsules, as depicted in figures 3 *D* to 4 *A*; in the fibrous substrate of thrombosed urethral caruncles, in abdominal carcinomas with ascites, in cavernous hemangiomas of the liver and in corpora lutea of pregnancy, as shown in figure 4 *B* to *F*. In this study they were most frequently found in relation to old hemorrhage or to protracted tissue insult. Accordingly, formation of cytoid bodies can be of widespread occurrence throughout the organism, under certain circumstances. In order to attempt understanding of the mechanism of their formation it might be well to mention that cytoid bodies were not presently found in the tissues in hemorrhagic mural infarctions of the cardiac ventricles, in testicular hematoceles, in anthracotic lungs with hypostatic pneumonia, in hemorrhagic infarctions of the suprarenal gland, in jejunal infarctions or in freshly ruptured tubal ectopic pregnancy. They were also never found in hemorrhagic regions in which clasmatocytes or microglia cells were in abundance or in which these cells were laden with hemosiderin or hematoidin.

Since these formations are by definition a regressive product found among healthy cells, it should be noted that the following well recognized structures have not been mistaken for cytoid bodies: overladen or necrosing microglia cells, senescent clasmatocytes or histiocytes; holocrine masses, psammoma bodies, amyloid bodies; serous occlusions of dilated blood vessels, hyalinized cells at borders of massive degenerations; hemosiderin, melanin or other pigment agglomerations; calcospherites, mucin, etc.

GENESIS

It will be seen from the foregoing section that cytoid bodies may usually be found in proximity to, and probably arise oftenest in, areas in which there has been an old hemorrhage in a loosely-knit tissue which is not subjected to motion or agitation, and which also is not readily invaded by reticulo-endothelial elements. These bodies may on occasion, however, apparently arise by a process of inspissation from any static albuminous interstitial fluid (transudate, exudate or edema), or by coagulation necrosis and inspissation of what might appear once to have been overladen wandering cells. Figure 3 *E* shows a cytoid body composed of a hyaline agglomeration of erythrocytes, its knobby outline evidencing the embedded structureless cells; figure 5 *F* shows another type of evolution. Friedenwald [7] has arranged a series showing formation of cytoid bodies from necrosing wandering cells; there is no reason why they might not arise from such origin, but it was not defi-

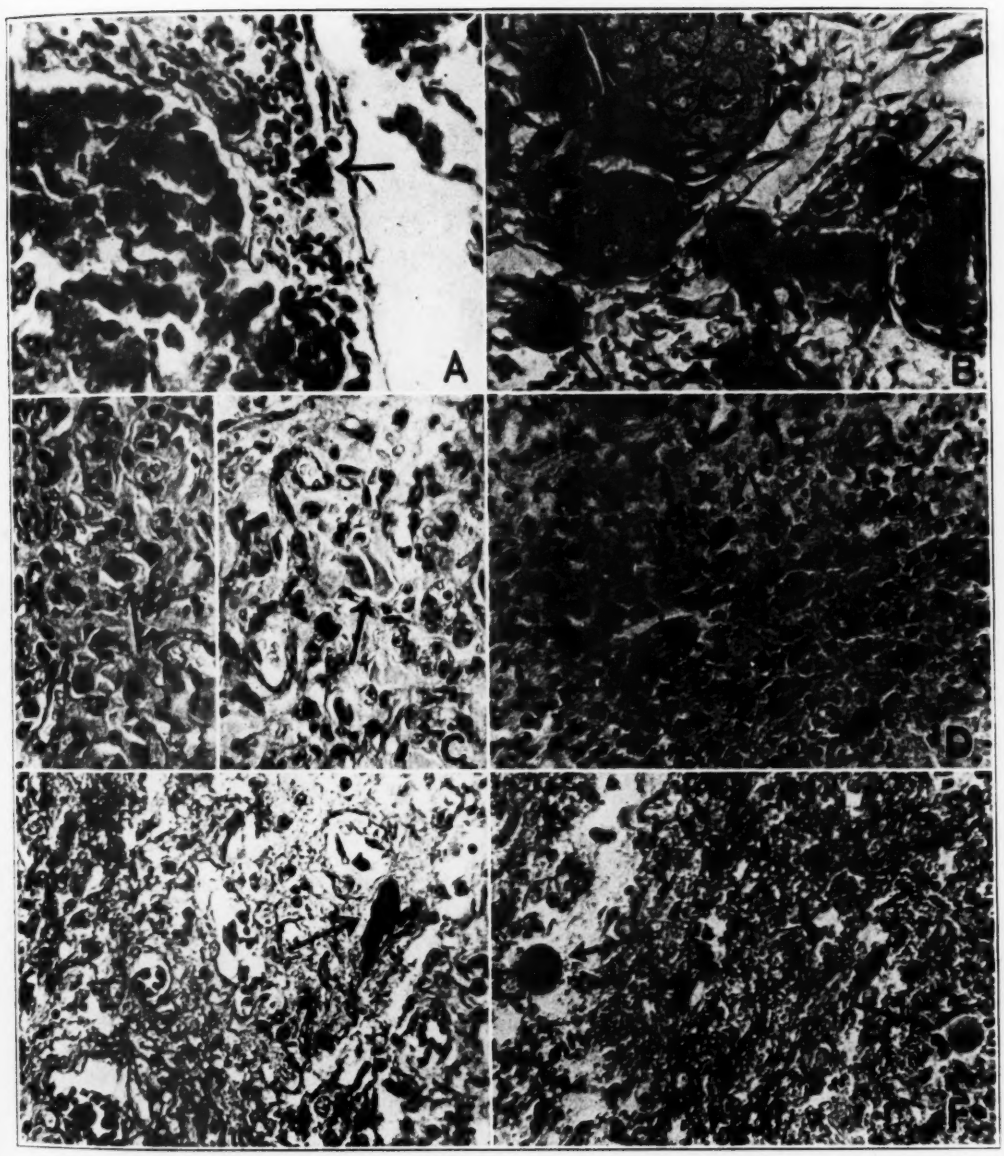

Fig. 3.—*A*, pinealoma. *B*, edematous basal nodule of the craniopharyngioma. *C*, mural nodule of a cystic hemangioblastoma of the cerebellum (operatively removed tissue). *D*, peripheral zone of a gumma of the temporal lobe. *E*, club-shaped cytoid body in the periphery of a gumma; Mallory's phosphotungstic acid stain. *F*, capsule of a cerebral abscess of four weeks' duration. All photomicrographs are of uniform magnification of about 140 diameters.

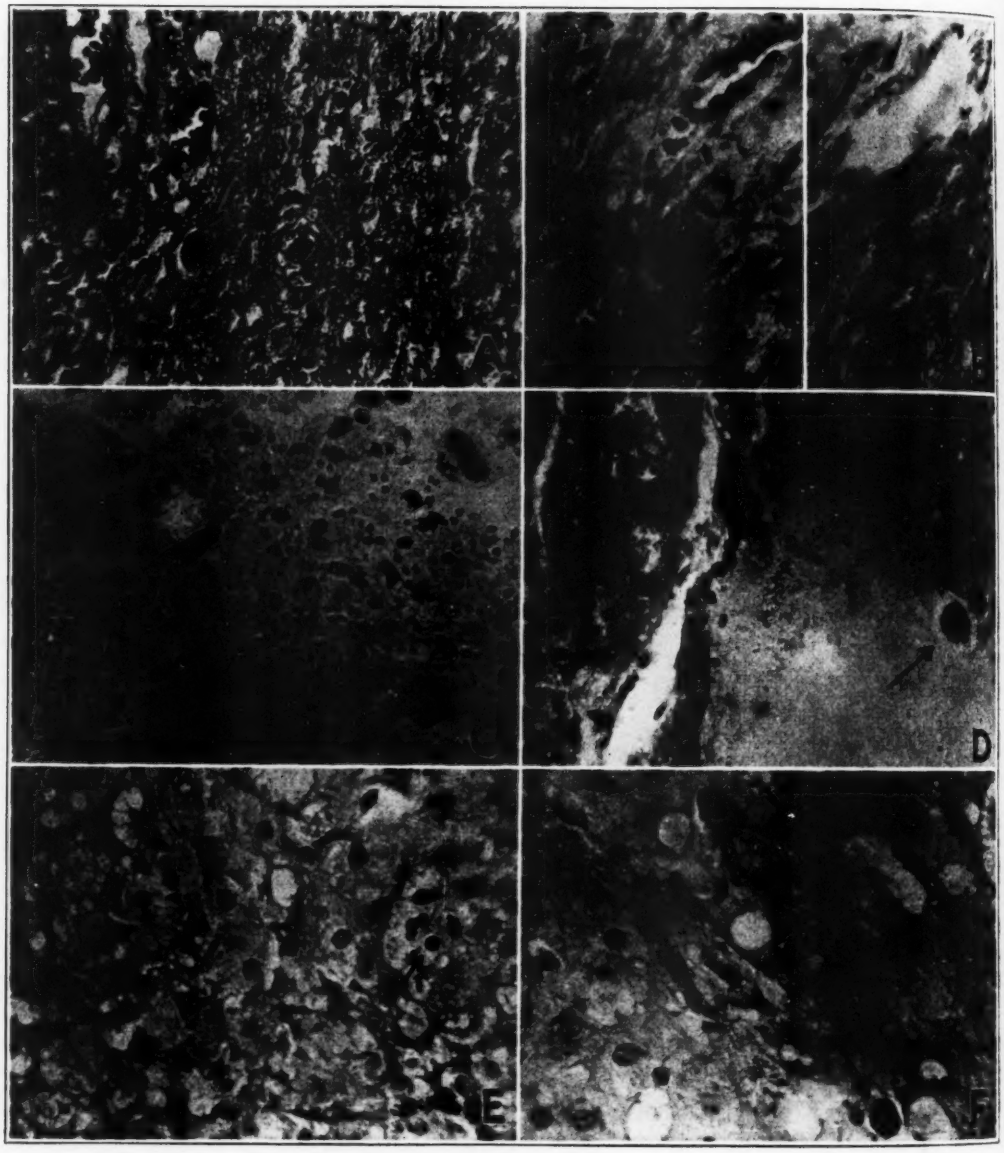

Fig. 4.—*A*, capsule of cerebral abscess of four weeks' duration. *B*, stroma of the basal pedicle of an excised urethral caruncle. *C*, border of a hepatic nodule from abdominal carcinomatosis with ascites. *D*, small cyst in a cavernous hemangioma of the liver. *E* and *F*, corpus luteum of pregnancy. All photomicrographs are at a uniform magnification of about 140 diameters.

nitely observed in the preparations reviewed for this report, though the appearances in figure 6 *F* and *G* might be considered as suggestively favoring this mode of formation. It is unnecessary to recapitulate here disproved etiologic hypotheses already of record in texts, such as are quoted under "Definitions." The observations under "Distribution" have shown, moreover, that cytoid bodies are peculiar to no region of the body and are characteristic of no type of tissue. They are merely a temporary sequestration product of degeneration. They are found to occur in motionless, sodden tissues, with poor scavenger cell response, and conversely they are not found in areas in which motor activity massages the interstitial spaces (heart, lungs and jejunum) or in areas which are thickly invaded with histiocytes.

IDENTITY

As the nature of cytoid bodies has been such a debatable subject in ophthalmic histopathology, and since it appeared during this limited survey that they nevertheless represent a widespread special mechanism of degeneration limited to no particular anatomic region, adequate identification of them was imperative at the outset. Roth's drawings,[8] Friedenwald's photograph, Verhoeff's illustrations together with the foregoing descriptions, as well as microscopic preparations of an intraorbital glioma of the optic nerve,[4] were used as standards. Inspection of a library of microscopic preparations of gliomas showed the frequent presence of these bodies. They were found to be especially common in spongioblastoma polare, ependymoma, ganglioneuroma and astroblastoma,[9] while none were observed in glioblastoma multiforme, oligodendroglioma or astrocytoma, unless there was obvious evidence of antecedent interstitial hemorrhage within the neoplastic tissue or unless they bordered an area of edematous necrosis. With this background it became relatively simple to trace cytoid bodies in other intracranial lesions and elsewhere throughout the body as already described and illustrated.

The objection may be raised that simple hematoxylin-eosin and phosphotungstic acid-hematoxylin stains are not sufficient for identification and that true cytoid bodies have been herein confused with structures so closely resembling them as to be indistinguishable. This might be conceivably true, for the origin of cytoid

8. Roth, M.: Beiträge zur Kenntnis der varicösen Hypertrophie der Nervenfasern, Virchows Arch. f. path. Anat. **55**:197 and 517, 1872 (contains references to earlier literature).

9. Most tumors in this group occur subcortically or are basal and often are physically subject to more compression, for various reasons, than the second group; the interstitial hemorrhages and stases are more minute, because of their compactness and structure. Microglia cells (the probable intracerebral representative of the reticulo-endothelial system) are practically never found within the borders of gliomas, it may be stated in passing.

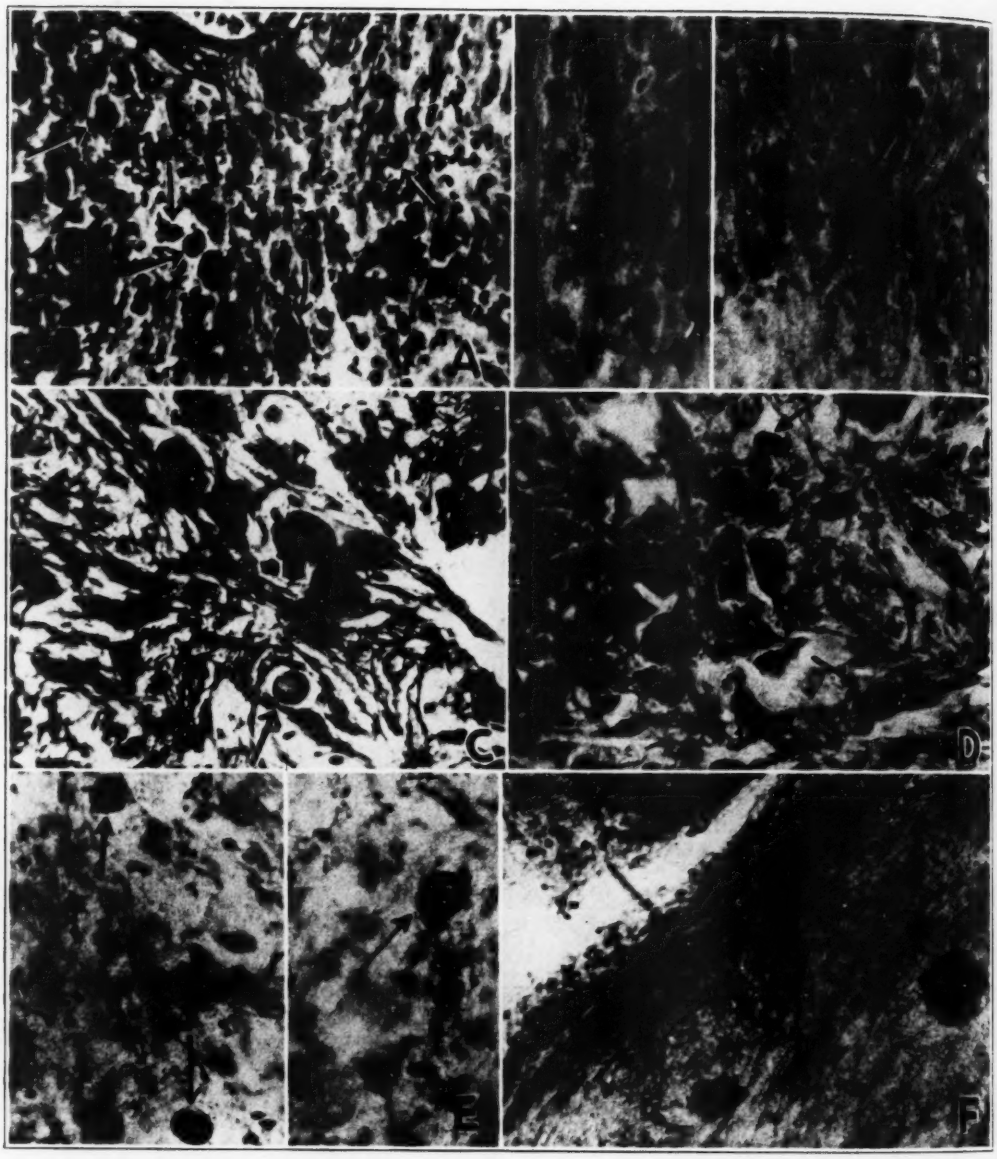

Fig. 5.—*A*, spongioblastoma polare; Hortega's silver-lithium-carbonate stain. All stages of tinctorial alteration, from faint magenta through violet to granular blue-black, are readily visible. Note the abundance of small droplets and of pigment granules. *B*, spongioblastoma polare; gold sublimate stain. Note the several degrees of metachromism of the cytoid bodies and auriphilic granules in the tumor interstices and in the adventitial clasmatocytes. *C*, central ganglioneuroma; Hortega's fourth variant. *D*, central ganglioneuroma; Bielschowsky's stain. *E*, cytoid bodies in a ganglioneuroma; gold sublimate stain. *F*, nodular meningioma of tentorial incisure, showing cerise erythrocytes and erythrocytic ghosts in the deep cleft of the tumor; a few cerise erythrocytes in the stroma; a violet hyaline encystment a little out of focus, and a blue-black granular metachromic aggregation of altered erythrocytes, most other morphologically similar aggregations elsewhere showing only normal erythrocytic coloration; gold sublimate stain. All photomicrographs are at a uniform magnification of about 140 diameters.

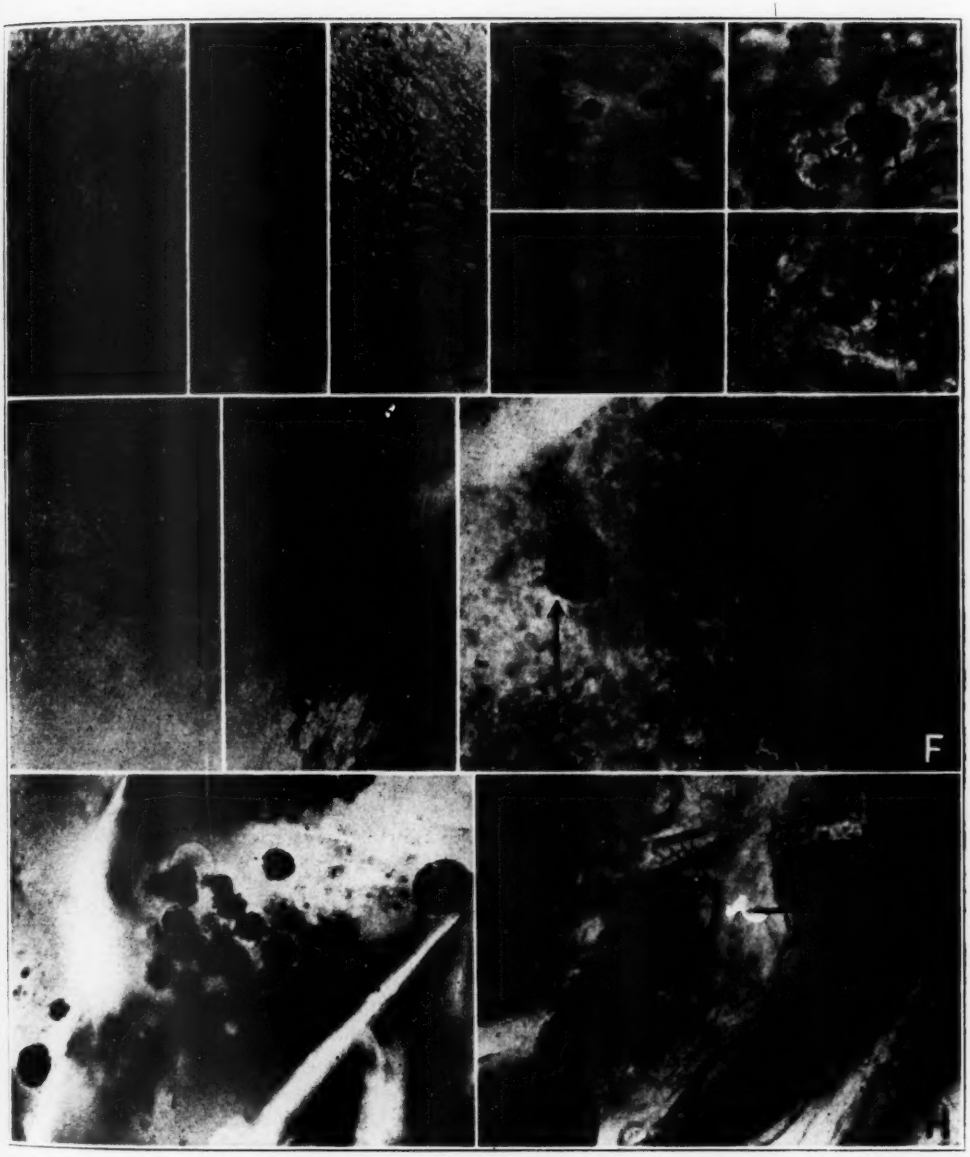

Fig. 6.—*A* and *B*, cytoid bodies in a meningioma; gold sublimate. *C*, the same as 5 *F* and 6 *A* and *B*; Held-Cajal's stain. *D*, cytoid bodies in a corpus luteum of pregnancy; gold sublimate stain. *E*, cytoid bodies in a corpus albicans of the ovary; gold sublimate stain. *F*, violet hyaline cytoid body containing black granules in an encapsulated hemorrhage in an adenoma of the thyroid; gold sublimate stain. *G*, auriphilic cells in a hemorrhagic cyst of an adenoma of the thyroid. *H*, cytoid bodies in colloid of a fetal adenoma of the thyroid; gold sublimate stain. All photomicrographs are of a uniform magnification of about 140 diameters.

bodies is obviously diverse, but special vigilance has been utilized to avoid such confusion. On the basis of many observations I am of the opinon that structures definable by any criteria as cytoid bodies are not characteristic of neuroglia.

Glia is composed of microglia, oligodendroglia, neuroglia (or classic glia, i. e., protoplasmic and fibrillary astrocytes) and its half a dozen or so developmental forms. Unmistakable cytoid bodies are found in abundance in tumors other than astrocytomas, and in more primitive glial tumors which can be demonstrated individually not to contain adult glial cells (i. e., neuroglia); this may be done readily in ependymomas and in spongioblastoma polare. In fact, one of the most profusely cytoid-studded tumors I have examined was the spongioblastoma polare shown in figure 1 *E* and figure 5 *A* and *B*; this tumor is at least two developmental steps primitive to classic neuroglia. It might be contended that the cytoid bodies, so abundantly found in the mural ganglioneuroma of the third ventricle, shown in figure 5 *C* to *E*, arose from sparse intermingling of adult neuroglia; however, it was practically impossible to demonstrate an astrocyte in this tumor.

If cytoid bodies, however, are derived from neuroglia, they should have the specific impregnating properties of the neuroglia. The most specific and selective histologic reaction developed for this cell is its response to gold sublimate, the specific Cajal stain for astrocytes. Cytoid bodies stain with gold sublimate in the same manner as do astrocytes, as shown in figure 5 *B* and *E;* that is, they impregnate a deep blue-black, either uniformly or as a multitude of fine or coarse granules. When they are swollen, they become varying shades of purple, violet and rose, and are usually of uniform density. (They also stain dark reddish purple with Bielschowsky's stain, light reddish purple with Hortega's fourth variant, dark or pallid grayish purple with Hortega's silver-lithium-carbonate and lemon to brown with the Held-Cajal pyridine-silver stain; the latter group of stains, however, are not considered sharply specific for astrocytes solely.) If one now applies the gold sublimate stain to tumors other than astrocytomas, one finds that cytoid bodies therein still stain characteristically, even in spongioblastoma polare [10] or ganglioneuroma.[10] Further, when preparations of a meningioma [10] showing cytoid bodies are treated with gold sublimate, the characteristically staining bodies are readily discoverable, as shown in figures 5 *F* to 6 *A*, *B* and C; and this, moreover, is true also for corpora lutea [10] (fig. 6 *D*), corpora albicantes [10] (fig. 6 *E*), hemorrhagic adenomas of the thyroid [10] (fig. 6 *F*) and fetal adenomas of the thyroid [10] (fig. 6 *H*). In fact, as one applies the gold sublimate method to tissues which ordinarily are not subjected to its use, one is struck by the diversity of structures, granules and cells which display affinity for gold, varying vastly in intensity and in gradation of color.

The derivation and metamorphosis of such granules and aggregations as constitute cytoid bodies may be observed to have been latent in the gold sublimate method from the start, provided that in examining the preparations one does not at once fix one's attention exclusively on only the striking astrocytic impregnations. One readily observes that blood in vessels [10] usually remains its normal faint salmon pink, and that hemosiderin (hematoidin?) usually retains its usual brassy orange, but also that both can be observed to undergo metachromic change at times. Stagnant blood in the central part of the lumens of moderate-sized vessels not infrequently is found to have lost its salmon tinge and to vary from faint steely blue to cerulean. Here and there certain blobs of disintegrating granular blood pigment take on blue-black coloration, in which, at times, one can make out

10. These tissues were originally fixed not in Cajal's formaldehyde-bromide but, as is common practice in neurohistology, in formaldehyde, and such parts as desired were then later submitted to Globus' ammonia hydrobromic treatment (Arch. Neurol. & Psychiat. **18**:263 [Aug.] 1927) before metallic staining.

faintly denser aggregations not dissimilar in size to erythrocytes, as shown in figure 5 *F*. These remarks concerning metachromism of erythrocytic derivatives are pertinent only for the gold sublimate stain; erythrocytes wherever found usually stain substantially as do cytoid bodies in Bielschowsky's stain, Hortega's fourth variant, Hortega's silver-lithium-carbonate, the phosphotungstic acid stain and Held-Cajal's stain; with phosphomolybdic acid-hematoxylin, erythrocytes sometimes show metachromasia from cerise to light purple when swollen and enlarged. In noncerebral tissues many clasmatocytes were found which contained intensely auriphilic granules, and some were tightly stuffed with them. Cells within old hemorrhagic areas in adenomas of the thyroid varied from granular black to anuclear hyaline violet, and within acini of fetal adenomas of the thyroid gland could be found intensely auriphilic cytoid bodies embedded in the lilac colloid.

It is evident from this particular group of observations utilizing the gold sublimate method that while the cytoid bodies found in gliomas exhibit staining reactions apparently identical with those shown characteristically by astrocytes, such bodies may be found in gliomas which are not composed of neuroglia and in intracranial tumors not composed of neural tissue. They may also be found in nonneoplastic tissue, and even moderately abundantly in the interstices of extracranial tissues of diverse origin. Their not infrequent special derivation from erythrocytes can be traced in its several stages by this staining method.

COMMENT

Except as such bodies need be, and have been elsewhere, recognized for what they are (as with pyknosis, vacuolation or other of the innumerable facets of degeneration), there is, from our point of view, no good reason why the neuropathologist or the general pathologist should dwell on them or grant to them inordinate attention. The reason they have been stressed by ophthalmologic pathologists is apparently that the bodies have never heretofore been specifically sought outside the orbita ocularis for wider correlation.

CONCLUSIONS

1. The peculiar cytoid bodies long observed in ophthalmology are but a regional evidence of regressive products sequestered in the same manner and circumstance as in other tissues throughout the body. Though commonly arising by hyaline inspissation of coalesced sequestrated erythrocytes in interstitial spaces feebly cleansed by movement or by phagocytic action, they may arise by a similar process from any albuminous fluid or phasic protein gel.

2. Cytoid bodies are a product of degeneration and cannot be properly used in the differential identification of special tissues, since they are characteristic of no particular tissue and are not a product of the immediate parenchyma or stroma in which they are found embedded.

550 Medical Arts Building.

Drs. Warren C. Hunter, Frank R. Menne, Karl H. Martzloff and Frederick A. Kiehle gave assistance and criticism in the preparation of this paper.

PATHOLOGIC CHANGES IN ANTERIOR HALF OF GLOBE IN CASES OF OBSTRUCTION IN CENTRAL VEIN OF RETINA

BERNARD SAMUELS, M.D.
NEW YORK

Excluding injuries and tumors, there are probably more eyes enucleated among elderly persons for the relief of absolute glaucoma secondary to obstruction in the central vein of the retina than for any other reason. The disease increases with advancing years, a fact which is of common experience. Pain and inflammation play a great rôle in this type of glaucoma. A similar type of painful glaucoma may ensue as a complication in any case of detachment of the retina. In both instances operations for the relief of glaucoma seldom prove successful. After an operation the tension may rise higher than it was before, and the pain may be greater. In glaucoma following obstruction in the main vein, an examination reveals a characteristic picture: an anterior chamber of normal depth, often containing blood, a small pupil and an iris with newly formed vessels on its surface, all of which are of diagnostic importance. It is usually impossible to see the fundus, not alone because of the smallness of the pupil and the blood in the anterior chamber, but because the vitreous is apt to be clouded by red blood cells derived from the engorged and ruptured veins of the retina. The history is of aid, since in most instances almost complete blindness comes on rather suddenly and the patients are at once aware of it, just as they are aware of the abrupt onset of blindness in cases of embolism in the central artery. Especially difficult to diagnose, once glaucoma is fully developed, are the rarer cases in which gradually failing vision has been noticed for some time prior to the advent of blindness. Such cases are to be distinguished from those of necrotic sarcomas of the uvea, in which there are blood in the vitreous and aqueous and increased tension. In hyphemia of a necrotic sarcoma the anterior chamber is shallow and the pupil wide, although as an exception it may be small. In glaucoma associated with detachment of the retina the pupil is often small, and the anterior chamber may be even deeper than normal. Transillumination is not always reliable, because innumerable phagocytes, having invaded a hemorrhage in the subretinal space, may set free so much pigment in their bodies as to throw a shadow

Read at the Seventieth Annual Meeting of the American Ophthalmological Society, Lucerne, Canada, July 11, 1934.

and lead to a diagnosis of necrotic sarcoma. The pain associated with glaucoma after obstruction in the main retinal vein and after detachment of the retina differs from that of the ordinary type of glaucoma by its severity and intractability, in spite of therapeutic measures, whereas in the common forms of acute glaucoma the pain tends to subside.

In 1924, Moore [1] published a monograph containing an exhaustive clinical study of sixty-two cases of what he termed "retinal venous thrombosis," which he had followed over many years. In thirty-one cases the obstruction was in the main vein, and in thirty-one it was in a tributary. In this series glaucoma developed only when the obstruction was in the central vein. The average period of time between the occurrence of the obstruction and that of the glaucoma in seven cases was estimated at eighty days. In no case was useful vision preserved. According to Moore it is the rarest clinical finding that the retina ever becomes free from hemorrhages, even after many years, although the obstructed circulation may appear to be adequately compensated by the development of many dilated and tortuous capillaries around the nerve head. He not infrequently found spots of arteriosclerotic retinitis, and white areas of fluffy woolly appearance were frequently seen in connection with the hemorrhages. Of the series of sixty-two cases, a gross cerebral vascular lesion was known to have developed in 41.6 per cent, and the average length of life after the development of the venous picture was 5.8 years.

In 1907, Verhoeff [2] reported the anatomic findings in six cases of obstruction in the central vein. He was able to find in the literature anatomic descriptions of thirty-nine cases. Analyzing the findings in these cases and in his own, Verhoeff came to the conclusion that the classic ophthalmoscopic picture of hemorrhagic retinitis after obstruction in the central vein is produced far oftener by endophlebitis obliterans than by thrombosis.

In 1933, Salzmann,[3] in a monograph, painstakingly recorded the anatomic picture in the region of the nerve head in sixty-five eyes that were enucleated because of absolute glaucoma. Confirming Verhoeff's deductions in the main, he ascertained that an occlusion in the vein frequently causes glaucoma, yet glaucoma itself frequently leads to occlusion in the vein by causing its wall to collapse from compression, which fact, he emphasized, has been undervalued.

---

1. Moore, R. F.: Retinal Venous Thrombosis: A Clinical Study of Sixty-Two Cases Followed Over Many Years, London, George Pulman and Sons, Ltd., 1924.

2. Verhoeff, F. H.: Obstruction of the Central Retinal Vein, Arch. Ophth. **36**:1, 1907.

3. Salzmann, M.: Glaukom und Netzhautzirkulation, Berlin, S. Karger, 1933.

It is not necessary to introduce a discussion of all the literature in this article. The writings on this subject, especially those of Coats',[4] elucidate mainly the changes and the problems presented in the posterior half of the globe. However, there does not seem ever to have been an adequate study of the changes presented in the anterior half of the globe, which are also characteristic. I deem it not inopportune to report the results of a systemic investigation into the pathologic anatomy of the anterior half of the globe in an endeavor to throw light on the pathogenesis of the peculiar type of glaucoma that frequently follows obstruction in the central vein.

Among the theories that have been advanced in explanation of the increase in tension, the following come to mind:

1. The theory usually given in the textbooks is that there is a general intra-ocular stasis of the blood and lymph, owing to blockage in the main vein. This explanation is not satisfactory because one would expect an increase in tension immediately after the occlusion, coincident with the greatest amount of pressure in the veins, as shown by edema and hemorrhage in the papilla and retina, and yet, according to Moore, the globe is softer than normal immediately after the obstruction. Months or years may elapse without signs of trouble other than blindness.

2. Glaucoma might be due to a swelling of the vitreous body caused by an imbibition of albuminous substances derived from the hemorrhagic areas in the retina. A swollen vitreous would carry the lens forward, bearing with it the iris and the angle of the anterior chamber. It would press on the ciliary processes and cause congestion in them and in the iris. But one would expect a shallow anterior chamber. On the contrary, the anterior chamber retains its normal depth, and the eye may outwardly remain quiescent indefinitely.

3. Glaucoma might conceivably be caused by a parallelism of congestion in the retina and the choroid, as a result of sclerosis of the two vascular systems, but it is known from pathologic experience that sclerosis of the retinal system is more likely than not to be found without sclerosis in the uveal system.

4. Glaucoma might be produced by a change in the fluidity of the aqueous, brought about by the presence of colloidal substances carried forward from the hemorrhages and serum in the vitreous and the retina. This was the theory promulgated by Coats. However, in other conditions of extensive and long-lasting hemorrhage in the retina and the vitreous glaucoma does not follow, so that this theory, as Coats admitted, is assailable.

---

4. Coats, G.: Complete Obstruction of the Central Vein of the Retina, Roy. London Ophth. Hosp. Rep. **16**:262, 1904.

5. Glaucoma could be caused by a change in the metabolism of the eye produced by toxic substances derived from a distintegration of red blood cells and a degeneration of the retinal tissues and of the stroma of the vitreous. It is conceivable that once such toxins had reached the aqueous an adhesive inflammation would be set up, leading to peripheral anterior synechiae.

From the standpoint of the last two hypotheses the question of the pathogenesis of glaucoma associated with obstruction in the central vein seems to be a matter for chemical research to ascertain in what respects the intra-ocular fluids differ from the normal. The fact that

Data Concerning Clinical Histories

Total number of cases			29
Sex			
Women			8
Men			7
Sex unknown			14
Age			
	Women	Men	Sex Unknown
	32, 50, 53, 60, 66, 70, 73, 76	52, 60, 60, 65, 67, 70, 70	
Total	8	7	14
Duration of the Obstruction			
Cases			
1			8 days
3			3 to 6 months
6			1 to 3 years
1			12 years
18			Unknown
Duration of the Glaucoma			
1			Several days
3			A few weeks
7			3 to 6 months
1			1 year
17			Unknown

one is ignorant of what these alterations may be should prove no hindrance to an anatomic inquiry if one remembers that the chemical findings will be of little importance unless they can be correlated with a thoroughly investigated pathologic anatomy.

ANATOMIC AND MICROSCOPIC OBSERVATIONS

This paper is founded on a microscopic study of preparations of the anterior segments of twenty-nine globes. In each instance there was a clear record that the obstruction in the vein had preceded the glaucoma.

The accompanying table gives information in regard to the clinical histories.

The tension was frequently mentioned as being very high. Tensions of 60, 70 and 80 were noted.

There was a record of but two operations having been performed prior to enucleation, which fact was considered to be a sign of a general realization of the futility of surgical intervention to save these eyes.

The microscopic study was pursued in the following order:

Vascular Systems of the Retina and Choroid.—The disturbance in the circulation of the retina was often manifested by hemorrhages scattered anterior to the equator, and several times free blood was traced almost as far forward as the ora serrata. In the cases of most extensive retinal hemorrhages there was as complete an absence of evidence of

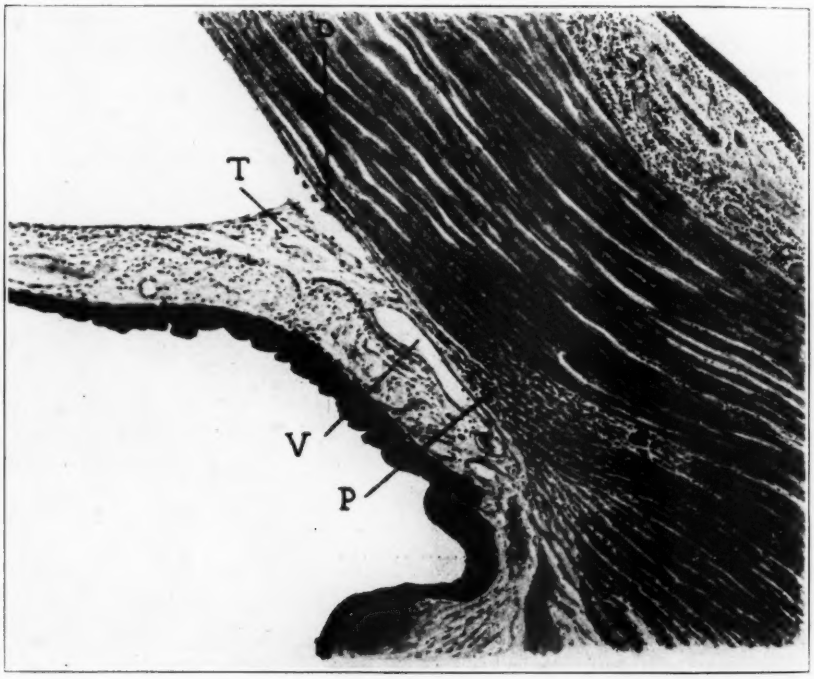

Fig. 1.—*T* indicates the triangular-shaped tissue situated between the margin of Descemet's membrane (*D*) and the anterior limiting layer of the iris. The triangular formation lies with a broad base on the iris and with its apex on Descemet's membrane. By means of this tissue the iris is fixed to the pectinate ligament and the periphery of the cornea. The spaces between the layers of the pectinate ligament (*P*) are less wide than normal. Schlemm's canal is obliterated. Between the pectinate ligament and the iris an empty vessel (*V*) is visible.

circulatory disturbance in the choroid as in those cases in which the retina showed a few or no hemorrhages anterior to the equator. From the standpoint of anatomy there is no ground for supposing that an obstruction in the central vein of the retina could have any influence on the circulation in the uvea except in a narrow zone at the choroidal foramen where anastomosis of small retinal and choroidal vessels takes

place. It is from this source that the dilated loops of veins are derived that serve to reestablish the circulation at the papilla. Furthermore, in confirmation of Moore's clinical observation that a disturbance of the pigment epithelium of the choroid is never seen clinically except at the fovea, the study revealed no special changes in the pigmented epithelium or in the choriocapillaris. A notable sclerosis in the choroidal system of vessels could not be distinguished in any case.

The Vitreous Body.—There were four cases that furnished definite evidence against the theory that a swelling of the vitreous had caused stasis by compression of the ciliary body. In these cases the vitreous was largely broken down and was detached posteriorly, being separated from the retina by an albuminous fluid. One is accustomed to associate a detached and broken-down vitreous with low tension. In nine cases there was blood in the vitreous, in two of which it was extensive. In eleven cases the vitreous appeared to be normal, proving that it is possible for glaucoma to occur after obstruction in the central vein without blood in the vitreous.

The Ciliary Body.—The ciliary body was atrophic in fourteen cases, but the atrophy was related particularly to the ciliary muscle as it is seen in glaucomatous eyes and in those of aged persons. In a striking way the ciliary body in case after case showed only such evidence of circulatory disturbance as could be assigned to the high tension. With few exceptions the ciliary body was remarkably free from signs of inflammation.

The Iris.—(*a*) The Stroma: In contradistinction to the ciliary body and the choroid, the iris presented a number of pathologic changes. In eighteen cases the stroma was atrophic. The word "atrophic" is employed in the sense that E. Fuchs used the term to describe the appearance of the stroma after inflammation. In glaucoma the stroma appears thinner, owing to a disappearance of its elements, but in low grade iritis the normal thickness may be retained, although the normal loose and delicate stroma is replaced by a more cellular and compact one. It was the latter type of atrophy that characterized the majority of irides of this series. The cellular elements were diffusely distributed, and there was no instance of lymphocytic foci. It was remarkable that in many cases the normal thick-walled vascular system of the iris was replaced by a system of atypical thin-walled vessels such as are familiarly seen under the microscope in atrophy of inflammatory origin. There were no hemorrhages in the irides, so that it could be said that no division of the uveal tract showed any unusual congestion. In several cases the stroma presented necrotic areas which were located in the pupillary zone. Once the necrosis in the iris was associated with necrosis

of the ciliary processes. Such areas of necrosis are not infrequent in glaucomatous globes. A number of times the stroma of the iris appeared to be normal.

(*b*) The Posterior Surface: The pigment epithelium was entirely unaffected in twenty globes. In five cases there was a simple posterior synechia at the pupil. In four cases its pupillary margin was drawn into a membrane that stretched across the lens.

(*c*) The Anterior Surface: In nearly every case a membrane was encountered lying on the anterior surface of the iris. The majority of

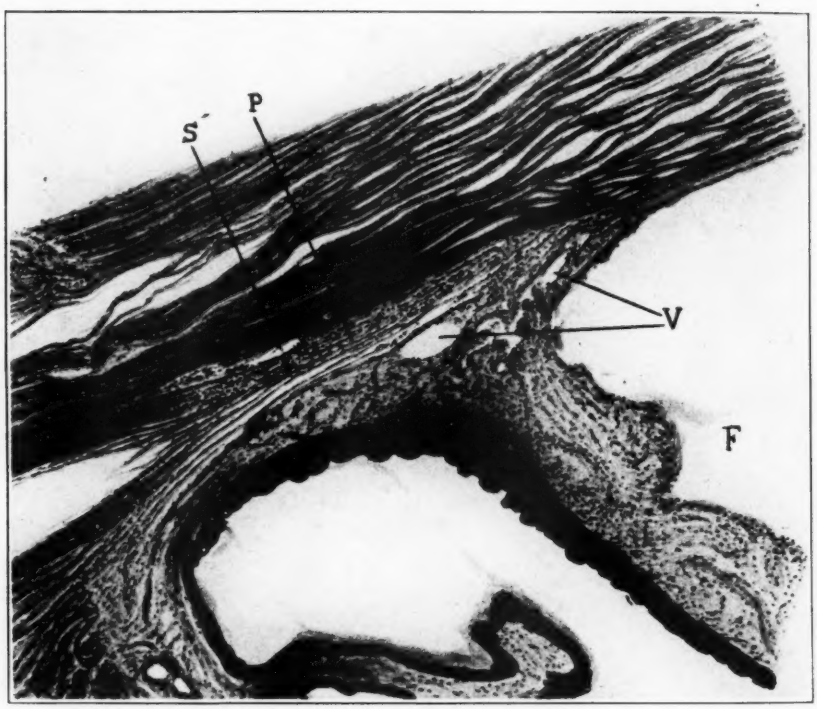

Fig. 2.—The root of the iris lies against the pectinate ligament (*P*), which is sclerosed. Schlemm's canal (*S*) is open and is filled with blood. The stroma of the iris is but little changed and is fixed by a vascular tissue to the periphery of the cornea, forming a pseudo-angle. The anterior chamber is filled with an albuminous fluid (*F*). In the area of the pseudo-angle are several thin-walled dilated blood vessels (*V*).

the membranes were located in the pupillary zone. Four consisted largely of endothelial cells. Eight were composed almost exclusively of capillaries. The greater number consisted of a mixture of endothelial cells, fibroblastic cells and blood vessels, the vessels usually predominating. The membranes were thin, and the walls of the vessels were delicate. There were two instances in which the membranes were

thick and had the characteristics of granulation tissue. The first was that in the globe of a woman 50 years of age. The eye had been inflamed for three months, and the tension was said to have been high. Granulation tissue entirely surrounded and overlapped the pupil. It was made up of cells chiefly of the epithelioid type containing a little pigment. The appearance of the tissue was suggestive of tuberculosis. It is known that tuberculous periphlebitis in the retina may involve the central vein and cause it to become occluded. The thrombosis spoken of in the history may have been of tuberculous origin. The second case was that of a woman 32 years of age. Obstruction in the central vein in young persons is usually atypical. In this instance thrombosis in the central vein was recorded as having taken place five years before enucleation. In addition to granulation tissue at the pupillary border there were endothelial plaques elsewhere on the surface.

The Angle of the Anterior Chamber.—In the investigation of the formation of the synechiae at the angle of the anterior chamber the specimens were separated into several groups.

(*a*) The Formation of Membranes: The specimens from one globe showed a thin vascular membrane that lined the pectinate ligament and the root of the iris. The angle was of normal contour. It is conceivable that with time this membrane would have become thicker and denser and by contraction would have drawn the movable root of the iris forward to become adherent to the unmovable pectinate ligament and cornea. Specimens of other globes revealed the sulcus lined by several layers of endothelial cells, loosely disposed.

(*b*) The Formation of Bridge Synechiae: There were two instances of so-called bridge synechiae, in which a narrow zone of the iris near its periphery was found adherent to the middle of the pectinate ligament. In this way the root proper of the iris and the external third of the ligament retained their normal relationship, forming the walls of an open space separated by the adhesion from the rest of the anterior chamber. Bridge synechiae are familiar in cases of iritis.

(*c*) The Formation of Fully Developed Synechiae: Broad adhesions, much broader than those commonly encountered in ordinary glaucoma, characterized the specimens from most of the globes. The adhesion was often so broad that it covered, in addition to the entire ligament, the periphery of Descemet's membrane. The synechiae were generally not very compact. Usually a compressed vascular membrane could be traced between the surfaces of the iris and the ligament. In spite of the breadth of the adhesion, Schlemm's canal was seldom compressed, as is the rule in ordinary glaucoma.

The Pseudofiltration Angle.—In coming away from its insertion on the cornea, the iris usually made a sharp bend of from 30 to 40 degrees,

forming what was termed the pseudofiltration angle, which, being located on the cornea, caused the pseudoroot of the iris to be at a much higher level than the free pupillary border in contact with the lens. The adherent portion of the iris never revealed as great an atrophy as one would expect with such broad adhesions.

Vascular Tissue in the Pseudo-Angle.—An extraordinary element in almost every case was the presence of a triangularly shaped vascular formation in the pseudo-angle. The base rested on the anterior limiting

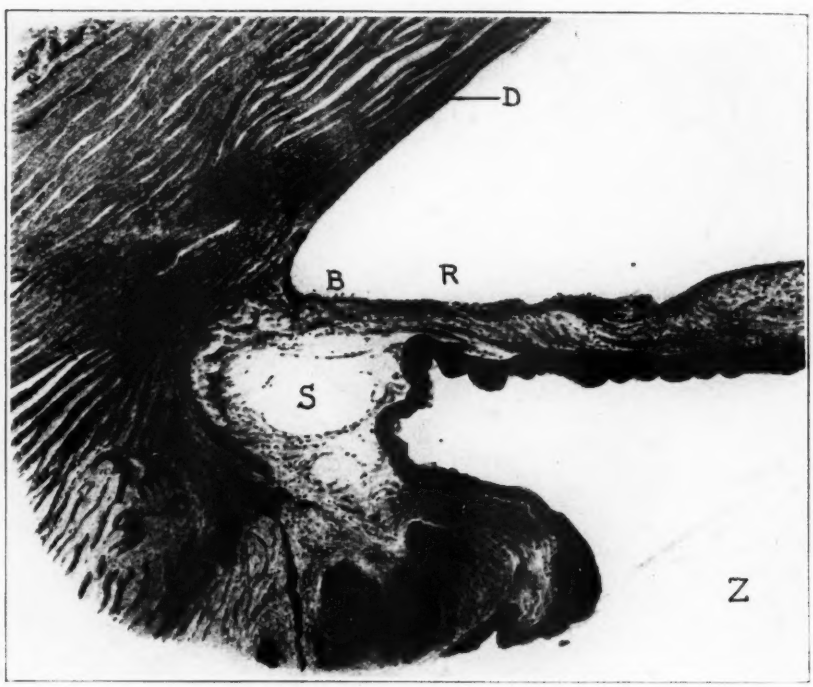

Fig. 3.—The root of the iris (*R*) is drawn by a tissue (*B*) toward the pectinate ligament, forming a bridge which separates the space (*S*) from the anterior chamber. The pectinate ligament is sclerosed, the lamellae lying close together. *Z* indicates zonular fibers, and *D*, the periphery of Descemet's membrane.

layer of the iris, and the apex was directed toward the cornea. At times the loops of capillaries were so numerous and so dilated that the structure acquired the nature of a cavernous tissue. From the triangular formation a thin vascular membrane usually spread out over the adjoining surface of the iris. There was but one case of a pathologic ectropion of the uvea, and that was of long duration. Perhaps the vascular nature of the membranes rendered them less contractile than more cellular membranes would have been.

The union between the iris and the pectinate ligament, in spite of its great breadth, was interrupted in a number of the globes. In explanation, it was noted that the iris was attached to the ligament by means of a vascular membrane, easily torn away, whereas in ordinary glaucoma the union is a direct cellular one in which the cells of the atrophic iris intermingle with those of the sclerosed ligament. How readily the adhesion may be separated in life was shown in three cases in which large hemorrhages had taken place in the anterior chamber. That the separation in these cases was not artificial was proved by the presence of a plug of blood in the slit formed by the separation.

Contents of the Anterior Chamber.—Hyphemia was encountered in the preparations from seventeen globes. In six cases the space was filled with a clear, albuminous coagulum indicative of active inflammation. A fibrinous exudate was seen once. Pigment granules were encountered several times. Once a few lymphocytes were noted, but there was not an instance of outspoken deposits on Descemet's membrane.

Comparison of the Findings at the Angle of the Anterior Chamber with those at the Nerve Head.—Taking the series as a whole, the glaucomatous excavations were not nearly so deep as one would expect, considering the broad extent of the peripheral anterior synechiae. There were sixteen cases of pathologic excavation. In four of these the recession was slight. In four cases there was no excavation. In the latter cases the atrophy of the nerve fibers in the trunk seemed to be as complete as in those cases in which an excavation was noted. It may be that the sudden congestion of the blood vessels due to the obstruction in the vein caused an inflammatory reaction in the lamina cribrosa, stimulating the connective tissue and glial cells to proliferate. In this way the perforations once occupied by frail nerve fibers could have been made smaller by the swelling and at the same time would be filled with a firm tissue capable of withstanding an increase in the intraocular tension.

INTERPRETATION OF THE ANATOMIC FACTS

Having described the pathologic anatomy, it remains to discuss the problem of the pathogenesis of the membranes on the anterior surface of the iris and on the chamber surface of the pectinate ligament, which, by forming a barrier to the outflow of the aqueous, caused the glaucoma. If one can discover what agency has excited the tissues to produce the membranes, the problem of the causation of the glaucoma is also solved.

Evidence in Favor of the Theory that Toxins Cause the Membranes.—It was striking that so many membranes were located in the pupillary

zone. One is accustomed to associate membranes in this zone with toxins, as one sees them form there when toxins reach this surface from in front by diffusing through the aqueous from an ulcus serpens of the cornea. The membranes are also seen in necrotic sarcomas when toxins are brought forward by fluid through the pupil. Again, they are seen when toxins reach the aqueous from the stagnant fluid dammed up in the subretinal space of an old detached retina. The toxins that are assumed to be generated after occlusion in the vein reach the pupillary zone of the iris first as they enter the chamber.

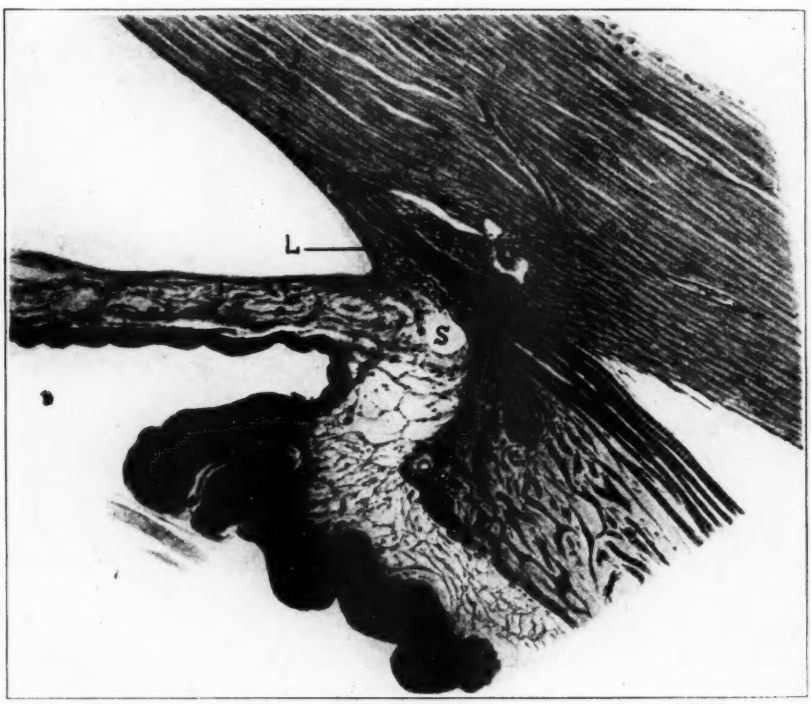

Fig. 4.—Here is shown the filtration angle in the same case as in figure 3, but on the opposite side. The root of the iris is attached to the pectinate ligament and is drawn toward it, bridging over a small tunnel-shaped space (*S*) which in the section appears to be round. The trabeculae of the pectinate ligament (*L*) are still open, as is Schlemm's canal.

The anterior limiting layer of the iris is more delicate here than in the ciliary zone, and, in addition, the circulation, being the farthest removed from the greater arterial circle at this point, may be sluggish. These are the factors, it seems, that render the pupillary zone of the iris especially vulnerable to irritant substances in the aqueous and cause it to react by the formation of membranes on its anterior surface. As its root is approached the iris again becomes thin, so that the blood

vessels that radiate from the greater arterial circle are almost exposed to the aqueous as they lie in the crypts, over which the anterior limiting layer is lacking. It was considered that the proliferation of the endothelium so often seen in the sulcus was an expression of irritation from an accumulation of toxins there. To account for the overwhelmingly vascular element in most of the membranes, it was believed that the walls of the exposed blood vessels at the root of the iris received a stimulus from the toxins in response to which they formed capillaries. This may be likened to the condition wherein the blood vessels lying in contact with the internal limiting membrane of the retina sometimes are seen to react to toxins by sending capillaries forward into the vitreous body.

Evidence Against the Theory that Toxins Caused the Membranes.—The toxins in diffusing forward doubtless came in contact with the pigmented epithelial layers of the ciliary body and of the iris before they reached the anterior surface of the iris, so that one should expect membranes on these surfaces, and yet there were none present. Probably the epithelial layers are more resistant to the toxins than the endothelial lining of the anterior chamber. Probably in this fashion the vascular layer of the ciliary body and the posterior layers of the stroma of the iris were protected from toxins.

Manner of the Formation of the Membranes and Explanation of their Vascularity.—It appeared that the membranes formed directly from a proliferation of the endothelial cells and from a simultaneous sprouting of capillaries from the radiating branches at the root of the iris. It was clear that they did not represent an organization of an exudate, because the anterior chamber was singularly free from cellular débris. Whenever there was blood it was plain that the membranes were preexistent. The membranes, being delicate and vascular, were always sharply delimited from the underlying dense, pigmented anterior limiting layer of the iris. No direct communication could be traced between the blood vessels in the vascular loops in the pseudo-angle and in the membranes and the vessels in the stroma. The blood vessels in the two systems were traced to a common origin in the radiating branches as these branches were given off from the greater arterial circle in the vascular layer of the ciliary body. The typical blood vessels in the stroma, which substituted for the original thick-walled ones, which were possibly out of place in an altered parenchyma, kept to the stroma, whereas the others sprang forward and mounted over the anterior limiting layer to supply the membranes of endothelial derivation. That the membranes were traversed by so many dilated and tortuous capillaries and that the pseudo-angle was so frequently occupied by great distended loops of capillaries were attributed to a disturbance in

the circulation caused by the synechiae, which, in growing more compact, interfered with the return flow of the blood from the membranes.

Origin and Nature of the Toxins that Produced the Membranes.—The toxins must have had their source in the disintegration of constantly

Fig. 5.—The root of the iris is separated by blood from the pectinate ligament (*P*), but evidently it was adherent to the cornea previous to the occurrence of the hemorrhage. The pectinate ligament is sclerosed. The parenchyma of the iris is very dense, but it retains its normal thickness.

Fig. 6.—A newly formed membrane (*M*) is lying on the pupillary area of the iris. The pigmented layers at the pupillary border appear as if they were pushed backward. The sphincter muscle (*S*) is normal.

recurring hemorrhages and exudates in the retina. The toxins could not have been virulent; otherwise they would have caused cyclitic membranes to form on the internal surface of the ciliary body and the posterior surface of the iris as do the toxins produced by bacteria that

are introduced into the vitreous. The toxins must require time to gain force enough for their action to be felt. Possibly other forms of recurrent hemorrhages may produce just as many toxins, but in these cases the posterior efferent pathway of the lymph at the papilla is open so that the toxins are carried off and not diffused forward. It was the combination of hemorrhage and blockage that seemed to bring about the glaucoma in the cases of this series.

It is most likely that a similar combination produces the glaucoma in cases of old complete detachment of the retina in which the posterior efferent pathway of the lymph is sealed by membranes that form on the nerve head. In cases of ordinary glaucoma the anterior pathway is first affected, and only gradually does the posterior pathway become blocked as the excavation increases and the condensation of the lamina cribrosa progresses. That membranes do not form on the iris and that glaucoma does not ensue in other types of long-lasting recurrent hemorrhages in the retina may be understood by the fact that in these cases the posterior efferent pathway of the lymph remains open, whereas in obstruction in the central vein its closure may possibly be almost coincident with the obstruction in the vein. It therefore comes about that in the causation of the glaucoma that follows occlusion in the central vein there are three anatomic factors to be borne in mind: (1) a disturbance in the blood outflow caused by an obstruction in the main, vein, (2) a disturbance in the lymph outflow by a blockage in the efferent pathway by congestion and edema at the nerve head and (3) a disturbance in the aqueous outflow caused by membranes and adhesions at the angle of the anterior chamber. That glaucoma does not occur in every case of obstruction in the central vein may depend on the rapidity or slowness of the onset of the obstruction, giving more time in some cases and shorter time in others for the establishment of a collateral circulation at the nerve head.

CONCLUSIONS

1. Two conditions seemingly combine to produce the intractable pain—glaucoma and inflammatory reaction from toxins, the latter persisting and increasing after glaucoma sets in.

2. It is probable that in many cases the glaucoma progresses in three stages: (1) the prehemorrhagic stage, in which there may be no subjective symptoms but in which the tension may be slightly elevated and the slit lamp reveals the beginning of capillary formation on the iris; (2) the first hemorrhagic stage, in which there is hyphemia and the eye is hard and painful, and (3) the second hemorrhagic stage, in which there is massive hemorrhage in the anterior chamber and the globe is stony hard and the pain unbearable. In this stage it is probable that many of the capillary loops have burst at the pseudo-angle and

that with the pouring out of blood the anterior chamber has become deeper than it was before, mechanically producing complete laceration of the pseudofiltration angle. Such were the cases described in the specimens, in which a plug of hemorrhage was found in the space made by the laceration.

3. The pathologic anatomy demonstrates why after operation these globes may be even harder and more painful than they were before. The thin walls of the engorged capillaries in the membranes, unable to withstand the sudden reduction in the intra-ocular tension as a result of the opening of the globe, rupture and set free so much blood that the end-result is a superimposition of hemorrhagic glaucoma on hemorrhagic glaucoma.

ORTHOPTIC TREATMENT OF CONCOMITANT SQUINT

JACOB B. FELDMAN, M.D.
PHILADELPHIA

The rear of the dispensary for diseases of the eye at St. Christopher's Hospital for Children has been partitioned off for the orthoptic department.[1] There are six small cubicles, comfortably furnished, making it possible to give instruction to several children at one time. The instruments which my associates and I have found necessary are: (1) a rotating illiterate test chart;[2] (2) a Worth deviometer; (3) a synoptophore; (4) a Keystone outfit; (5) a telebinocular with a small interpupillary distance, used for tracing; (6) an amblyoscope, which we electrified, and (7) a perimeter. Included with the slides for use on the stereoscope are the Hamblin series and a few of the less complicated Wells and Keystone slides, as well as the animated cards and several others. On the synoptophore the Sattler series and the transparent slides are used.

The problem of the technicians in training to correct squint is continuously to obtain new and interesting objects for study. This should not be a serious problem. Well known caricatures of grotesque figures always stimulate the interest of the child. Figures 1, 2 and 3 show some of the pictures and transparencies which our technicians have made and which are used in the various instruments. There are also many cheirographs for tracing, drawings to be filled in with color for the very young children, picture cutouts, blocks, games, modeling clay and many other trifles, each included with a view to stimulating the amblyopic eye, discouraging suppression and encouraging fusion.

We thought it best when the clinic was opened to have orthoptic treatment given by trained technicians under the supervision of the ophthalmologist. More than a year of work in this field has convinced me that this is the most logical manner of handling the problem.

Letters to various persons connected with the construction of the curriculum in the public schools did not assist us much in establishing an appropriate time limit for the orthoptic lesson. Indeed, it was

---

From the orthoptic clinic, St. Christopher's Hospital for Children.

1. Feldman, J. B.: The Squint Clinic at St. Christopher's Hospital for Children, Eye, Ear, Nose & Throat Monthly **12**:501 (Jan.) 1934.

2. Feldman, J. B.: Improved Illiterate Test Chart Cabinet, Am. J. Ophth. **17**:632 (July) 1934.

difficult to explain the advantages of stereopsis to some intelligent teachers, since they themselves did not have stereopsis. Laird,[3] in his excellent work on practical psychology, gave preference to several short periods of instruction over one long period in any endeavor. And we have found from experience that between twenty and thirty minutes, on the average, is the ideal period for instruction. After that fatigue sets in. Fatigue should be discouraged, since the tired muscles will not respond to treatment and the angle of squint is increased, as is shown by the synoptophore readings taken before and after fatigue has set in.

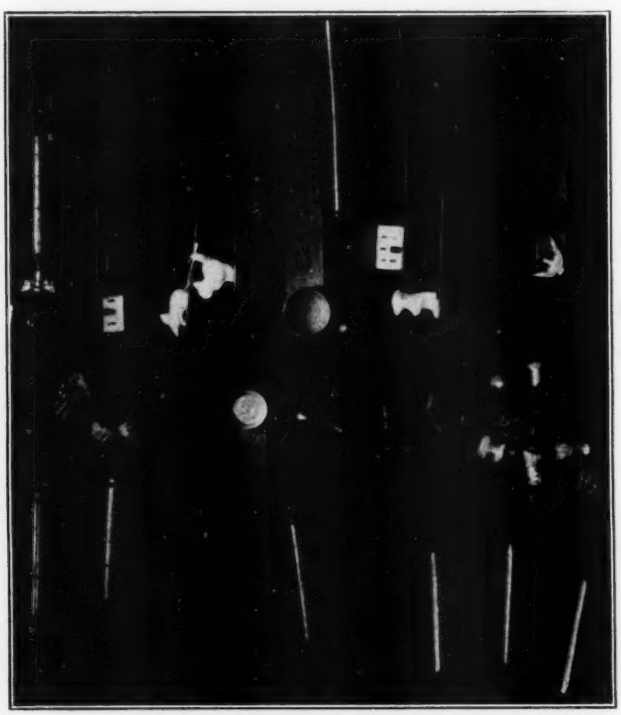

Fig. 1.—Solid articles on holders, used for small children on telebinocular.

Children, even as young as 6 months of age, are given glasses only and asked to return every six months for check-up. Occlusion is employed at this time, when necessary. We prescribe one pair of glasses, avoiding bifocal lenses, prisms, etc., to obviate inconvenience and expense to both the patient and the hospital.

We admit children to the clinic who show no improvement in squint after wearing glasses for six weeks, provided that the child has central fixation with no visible pathologic changes to hinder fusion and

3. Laird, Donald: Increasing Personal Efficiency, New York, Harper & Brothers, 1929, p. 30.

stereopsis. It is desirable that the child be in fair health and show moderate intelligence and cooperation. The clinic is open every afternoon for instruction. In order that the hospital may serve the greatest number of persons, and because many of the parents cannot afford the time or expense to bring their children, we have arranged to see patients once or twice a week, depending on the circumstances in the individual cases. It is possible that daily visits might help the patient more from a theoretical standpoint, but practically this method of daily

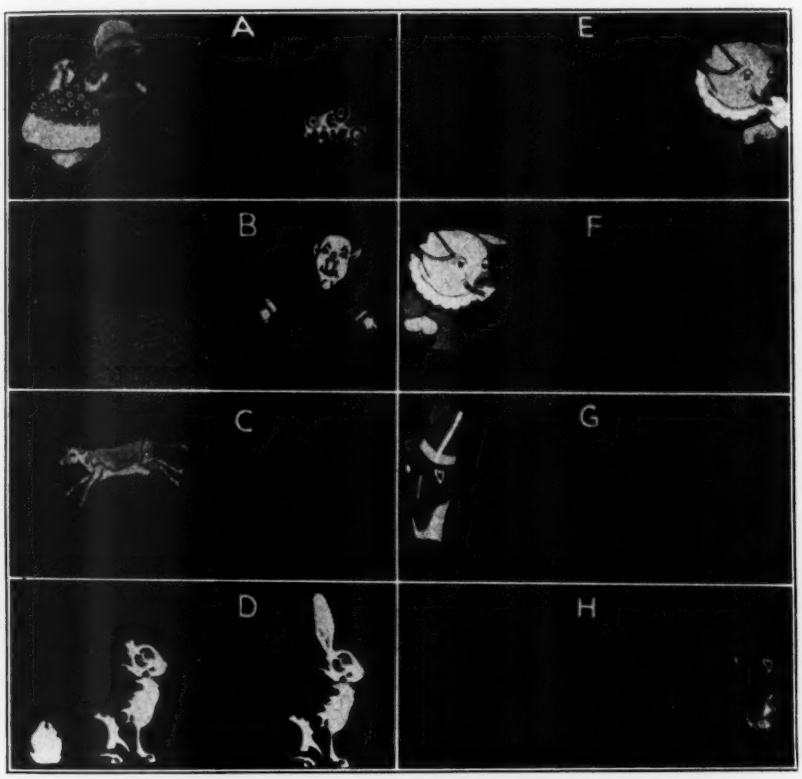

Fig. 2.—*A, B, C* and *D* are some of the cards used for fusion and simultaneous macular perception; *E, F, G* and *H* are some of the cards used for duction.

instruction would possibly cause the child to lose interest in the work and also would restrict the number of cases that we could handle.

All cases are reviewed once every four to six weeks, and notations are made. Examination of vision, the angle of squint, etc., is made, with and without glasses. In order to be discharged as cured, a patient must have fusion and stereopsis, as well as a good cosmetic result. We ask the patients to return in six months. Patients who show a lack of cooperation and laxity in attendance at the clinic for several consecutive weeks are discharged. Patients who after a number of treatments

show absolutely no improvement are also discharged. We have had some of these patients examined neurologically, and several were examined psychologically. Several cases in which there were stuttering, squint and many other minor defects, with an intelligence quotient much above the normal have led me to believe that not much encouragement can be expected from neurologic examination at present in regard to aiding us in our findings or treatment. We shall, however, continue to cooperate with the neurologic and psychiatric as well as with other departments of the hospital, with the hope that some of our problems may be solved. When it is thought desirable, an operation is recommended, after which the child is sent to the clinic to resume training

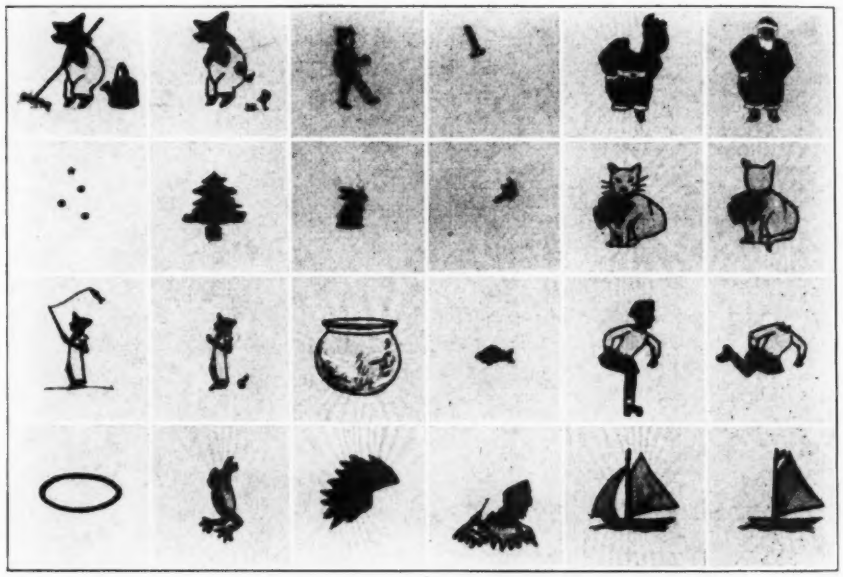

Fig. 3.—Transparencies in color for use in the synoptophore.

as soon as possible. The training in these cases then often proves successful. The time spent in the preoperative treatment is not considered wasted, for the child has possibly gained some benefit in learning to correct amblyopia and to discourage the use of a false macula.

We have several home training sets to rent with which children may do work at home. There is danger in using a home training set in cases in which a "false macula" is present, because the children do not use the instrument correctly so far as exercising the squinting eye is concerned. We therefore recommend this treatment in isolated cases only. Even the filling in of pictures with colors or exercises to stimulate the kinesthetic sense are probably not carried out faithfully by the patient at home.

We use the Worth method of investigation and classification of squint in the dispensary. When the child enters the orthoptic clinic a duplicate of the original record in the dispensary is taken, to which are added the daily notations observed by the technician while giving treatments. At the first visit we explain to the parent the purpose of the clinic, and hearty cooperation is urged. After this the patient is examined with the synoptophore to see whether he has simultaneous macular perception, fusion or stereopsis and whether his macula is true or false. If he has fusion, the point at which this takes place and the divergence power are noted. Then appointments are made and he is urged to keep them faithfully. Of course, if the child is shy or afraid, much of the time is spent in getting rapport.

Training to correct squint is divided into:

1. Preorthoptic treatment for congenital or acquired amblyopia
2. Orthoptic training for
   (*a*) correction of suppression
   (*b*) study of retinal incongruity
   (*c*) fusion and stereopsis
3. Setting-up exercises, which at the same time may assist in training fusion; these can be given at any time during the orthoptic training
   (*a*) vergence exercise
   (*b*) use of the cheirograph or eyegraph
   (*c*) work with cut-outs, drawings or building blocks, clay modeling and other interesting endeavors, as first suggested by Ernest Maddox.[4]

AMBLYOPIA

An amblyopic eye is one with poor vision with no visible pathologic changes. The condition is probably directly caused by long continued suppression as a result of an uncorrected refractive error. Amblyopia of the functional type, with which I am here concerned, is of two varieties: congenital and acquired. The congenital type is incurable; but, fortunately, is rare. At our hospital we found only four cases in twenty-five hundred children examined in which the condition could be called congenital. We have used the Hall test, as described by Atkinson,[5] for determination of congenital and acquired amblyopia in older children, with varying success.

About twelve years ago we tried treating patients with amblyopia ex anopsia by training the vision of the amblyopic eye while the patient was wearing glasses. Our method for such training is as follows: The line below that seen with the best obtainable vision on the Snellen chart

4. Maddox, E. E.: A New "Eye and Hand" Method of Training Squints, Am. J. Ophth. **13**:379 (May) 1930.

5. Atkinson, T. J.: Ocular Muscles and Fusion, Chicago, The Professional Press, Inc., 1933, p. 153.

is viewed by the amblyopic eye, and an attempt is made to read it. If necessary, the child is brought nearer the chart, and when the letters are just perceptible the child slowly steps backward, trying to keep them constantly in view. When the patient can see these smaller letters clearly, others of the same size are substituted to make sure that the patient is not memorizing the chart. The lesson takes but a few minutes, as the child must not be fatigued. A check-up of our results was made by Miss McComb, the head of our social service department, who supervised this type of training. In addition, letters were written to various schools asking the teachers of the children whether improvement in the vision of the individual children had been noted, and we received encouraging replies. I reported before the Philadelphia Pediatric Society about fifteen cases of improvement in vision from a group of thirty-five. Dr. Otis Wolfe [6] did a somewhat similar type of work independently and reported his findings.

On the same principle, the amblyopic eye can also be trained by using the various types of Keystone vision cards. Squint in eyes with amblyopia and high refractive error responds more readily to orthoptic treatment when the patient has been operated on early. Amblyopia is treated at the clinic by occlusion of the good eye, which is carefully watched to prevent it from becoming amblyopic. Sometimes we use a saturated red glass over the good eye, and as the amblyopia improves glasses of lesser saturation are substituted. This, I believe, gives less chance for the good eye to become amblyopic. When vision improves about 50 per cent in the amblyopic eye, instillation of atropine solution, 1 per cent, is substituted for occlusion. A valuable exercise for correcting amblyopia with the stereoscope is obtained by motility of the stimulus. This is accomplished by placing a small object, as, for example, the small twig of a tree, before the good eye. Before the amblyopic eye, well illuminated, a large bird attached to a rod is displayed. The bird in motion is quickly seen by the amblyopic eye. When necessary, a 10 degree prism may be used to augment the action of the squinting eye.

In cases in which amblyopia has once been present it is important to take readings for visual acuity often, and we have on numerous occasions tested vision in cases in which the condition was presumably improved and found the vision much poorer than it was at the previous reading. Sattler [7] reported a similar occurrence in amblyopia. It was also noted at the clinic that temporarily the squint may be increased while vision improves. This increase in the squint should not be assumed to be unfavorable. The squint usually lessens in time.

---

6. Wolfe, O.: Practical Application of Orthoptic and Fusion Exercises, Eye, Ear, Nose & Throat Monthly **7**:16 (Feb.) 1928.

7. Sattler, C. H.: Ztschr. f. Augenh. **63**:19, 1927.

SUPPRESSION

A suppressing eye is a good eye monocularly, but poor when binocular vision is desired. Suppression is the method by which the eye avoids the confusion of diplopia in beginning squint. It is at first purposeful on the part of the eye to avoid diplopia, but as the squint continues it becomes involuntary and no longer purposeful. The abolition of suppression in squint makes possible the three grades of binocular vision, i. e., simultaneous macular perception, fusion and stereopsis.

Alternating squint suppresses eyes alternately, and on this principle a patient with this condition is treated by us as a patient with unilateral suppression. For the same reason, one eye and then the other is covered for a varying period of time, in order slowly to break up this habit of alternation. We have recently begun this method of treatment in a few cases and may be able to report what success, if any, we obtain by this procedure.

In the study of the horopter it is interesting to note that Carleton and Madigan,[8] in their studies on difference in size, found that 71 per cent of their patients showed a form of suppression.

Suppression is noted on the stereoscope and the synoptophore when the child, on being questioned, is not aware of the presence of the control or Landolt spots or the horizontal and vertical white lines on some Keystone slides. In order to attract the suppressing eye the pictures used should be large, with some detail in red or blue. These colors are supposed to be effective in breaking up suppression. Sometimes heavy lines, such as a cage or net, are effective. Keystone cards (star and circle series) are valuable in both the diagnosis and the treatment of suppression. The benefit derived from the cards previously mentioned may be augmented by the 3 *A* Keystone vergence card, which should be read by one eye clockwise and then by the other eye counter-clockwise.

Suppression during exercises may be broken up by rapidly shaking the card which the child is viewing or moving the arm of the amblyoscope or synoptophore which holds the picture before the suppressing eye. Sometimes pointing to the area suppressed with a colorful object is helpful. Often the image can be regained when the child is asked to blink quickly. Another means is to hint to the child what objects are omitted by the suppressing eye. This often results in the child straining his attention to overcome this deficiency. Still another means is removing the plug to the light placed before the good eye or rapidly flashing the light over the bad eye for a few seconds. Too much flashing of the light is not good, as it proves tiring. Sometimes the light over both eyes can be flashed by the make-and-break contact on the synoptophore.

8. Carleton, E. H., and Madigan, L. F.: Size and Shape of Ocular Images, Arch. Ophth. **7**:720 (May) 1932.

The light may be slowly diminished before the good eye. Atkinson[9] suggested introducing prisms base up and base down of sufficient power to produce vertical diplopia of the moving target and then gradually reducing the dissociating prisms. This leads to binocular vision and to fusion of images. He recommends this treatment also in amblyopia. Diplopia occurring in the course of training to correct squint is considered a good omen, because it shows that the old habits of amblyopia and suppression are being abolished.

The synoptophore is valuable here in determining "pseudobinocularism," as noted by the quick shifting of the child's eyes from side to side, the child wrongly reporting fusion. This is not true binocular vision, but rapidly alternating monocular observation. This is an important reason for cutting out the top of the eyepieces in the stereoscope or telebinocular in order to see more readily the eye of the child.

Maddox,[10] in discussing stubborn cases with marked macular suppression, stated:

> Intensive and prolonged treatment may be necessary to overcome it, and the time taken will depend very largely on the mentality and power of application of the patient. It is interesting to note how both of these improve as treatment progresses.

Suspension is momentary suppression. It is often present in heterophoria and is treated like suppression.

SETTING-UP EXERCISES

This form of exercise may be likened to the type which the gymnast utilizes in order to limber up. The exercises may be used before or during orthoptic treatment to vary the monotony of a lesson, when it is noticed that the child is becoming slightly bored. Keystone vision cards, vergence exercises to train the extrinsic muscles for action in the various meridians, vergence card 1, which gives an angular radius of approximately 9 degrees, and vergence card 2, which gives an angular radius of 16¾ degrees, are used. The playing of various games, such as tick-tack-toe and the cat and the mouse, with the child looking through the telebinocular or cheiroscope, are included. Tracings, drawings and eye graphs may also be employed. To suit the needs of the very young child the telebinocular with a small interpupillary distance is useful. Many children hesitate to use their amblyopic or suppressing eye while drawing and tracing. In order to dispel their reluctance, we use a modification of the "R-G method" charts as described by Mayer.[11] We give the child a pair of glasses with a green

9. Atkinson,[5] p. 180.

10. Maddox: The Orthoptic Treatment in Strabismus, Tr. Ophth. Soc. U. Kingdom **51**:296, 1931.

11. Mayer, L. L.: Modern Developments in Orthoptic Training, Arch. Ophth. **8**:888 (Dec.) 1932.

lens before one eye and a red lens before the other and ask him to trace a white crayon picture on red paper. He is unknowingly using the defective eye over which the green lens was placed. This proves effective because the interest of the child is aroused and thus he forgets his prejudices. I believe that this test is also valuable for tracking down a malingerer.

The kinesthetic sense, or the association of the action of the eye with the muscle sense by means of the hand or sense of touch, is possibly the one which has developed by trial and error, in order to permit gaining a correct conception of the appearance of an object by its feel. The method of using cheirographs and copying is an attempt to induce the patient to correct the visual function by the sense of touch. While it is advisable to use the hand of the same side as the eye which is to be treated, it is not absolutely essential, and a patient with a defective left eye may trace with the right hand.

In doing tracings it is to be noted that short, quick sketching to and fro over the drawing keeps the attention of the eye—"foveal concentration"—on the work much better than long bold tracings. If the image slips, the flashing of a light or a bright card or the blinking of the child's eyes serves to bring it back.

RETINAL INCONGRUITY

Retinal incongruity, called also abnormal correspondence, is an acquired condition, common in alternating squint and possibly one of the reasons for the difficulty of its cure. When the two normal eyes view an object, it is seen by the "visual cortex" at corresponding points on either retina, representing the surface in space, the horopter. Disturbance due to squinting in either eye causes retinal incongruity by disturbance of the horopter. It may be inferred that true fusion and stereopsis are impossible when retinal incongruity is present. Thus, it is important to be able to evaluate these cases as to the type of retinal incongruity present before giving orthoptic treatment. Moncrieff [12] cited Georg Braun of the Elschnig clinic as dividing his cases into:

Group *A*. Those with constant normal correspondence, in which fusion and stereopsis may be obtained

Group *B*. A mixed group in which normal or abnormal correspondence may take place and in which simultaneous macular perception may be achieved

Group *C*. Those with fixed or constant abnormal correspondence, in which binocular vision is never obtained and in which it is best to leave the angle of the squint partly corrected in order to avoid paradoxical diplopia

12. Moncrieff, William: Disturbances of the Visual Functions in Concomitant Convergent Squint, Arch. Ophth. **2**:179 (Aug.) 1929.

The ideal time, of course, for examination for retinal incongruity is in very early childhood, when a diagnosis is most valuable. Madigan and Carleton,[13] in discussing the diagnosis and optical correction of this condition, gave the age of their youngest patient as 11 years. It is unfortunate that this mode of diagnosis and treatment cannot be carried out with younger children.

We are trying to obtain an approximate idea of the abnormal correspondence in our older patients by means of an improvised Tschermak *Congruenz Apparat*. How much success we have we shall report later.

TRUE MACULA

A true macula is noted on the synoptophore when the light reflex is in the center of the cornea slightly to the nasal side. If, on the other hand, a false macula is being used by the patient, it can be detected both by displacement of the corneal reflex and by a distinct shift of the eyes. The shift can be noted by shutting off the synoptophore lights alternately.

We use "retinal massage" in the clinic; it is found to be valuable in stimulating a true macula to function and is obtained by quick short movements of the arm of the synoptophore in the area of the true visual axis. "Oscillation" is another means of obtaining the same result. This is achieved by locking the arms of the synoptophore so that the true visual axes remain constant and oscillating the arms laterally. In the setting-up exercises that have already been mentioned it is to be noted that exercises for vergence and duction are not to be given when it is seen that the patient is using a false macula. When the child does not use his true macula, exercise is never given on any instrument which does not give a clear view of the patient's eyes, making it possible for the technician to discourage any use of a false macula.

It is necessary to make sure that the child will use his true macula before one begins intensive training. If the child persists in using his false macula, partial occlusion and kinesthetic training with and without the telebinocular should be given before exercises for fusion are begun.

SIMULTANEOUS MACULAR PERCEPTION

Simultaneous macular perception is the first milestone on the road of successful orthoptic training. This can best be achieved on the stereoscope as well as the synoptophore by using two dissimilar objects or pictures. Some of the pictures which are most popular with our patients are the lion in the cage, the mouse in the trap and putting balls on the Christmas tree.

---

13. Madigan, L. F., and Carleton, E. H.: A Clinical Report of the Corrections of Differences in Size and Shape of Ocular Images, Ann. Distinguished Serv. Found. Optom. **1**:71, 1932.

Training to correct squint with apparatus should not be begun when amblyopic vision is less than 20/70. For when vision is poor it is hardly possible that the child will obtain true binocular vision. Having improved the vision, exercise is begun by showing the child the pictures already described and explaining to him what is to be seen. If the child explains that he sees two distinct images we ask him some pertinent questions to verify the presence of true simultaneous macular perception. If he does not see the right thing we set in the arms at his true visual axis, making sure that he is using his true macula, and give him oscillation or retinal massage until the desired result is obtained. Sometimes the child succeeds in one or two lessons, but in the case of alternating squint the result is often more slow, sometimes taking a few weeks or months.

FUSION

Fusion is a normal process by which an image is seen singly and in its entirety through the unified action of both eyes. This is made possible through duction. It is probably acquired after the first six months of life and through the kinesthetic sense by trial and error and is fully developed at about the sixth year of life.

Color fusion is the simplest type of fusion obtainable, and I believe that the complementary colors yellow and blue are the simplest to fuse. In training for color fusion through the stereoscope the patient should first be shown the neutral color. A stronger light may be focused over the color seen by the squinting eye. The two cards of complementary colors are made to approach each other until fusion or the neutral color is obtained. A disturbance in the uniformity of the fused color would suggest a scotoma, if noted centrally or paracentrally. If there is a single uniform fringe of color around the neutral fused field, the condition is highly suggestive of peripheral contraction of the field and should be rechecked on the perimeter.

Color fusion may be accomplished by trying to fuse pencils of complementary colors on a background of a different pair of cards of complementary colors. For example, a yellow pencil is placed in front of a red card, while a blue pencil is placed in front of a green card. The two pencils are made to approach each other and fuse as one pencil. As they are approximated still more, they return to their original number, with the reversal of color. An excellent set for color fusion, duction and stereopsis is the "Stepping Stones to Binocular Vision" series, recently put out by the Keystone Company.

The next step after color fusion is form fusion. In the clinic the younger children are taught this by means of holding a little picture or toy placed at the end of a tongue depressor, while the technician holds its mate. Some of the toys used are shown in figure 1. The two objects are brought together for fusion as the child looks through the

stereoscope. The technician then moves his object up or down, and the patient is urged to make the objects bump into each other. The constant or inconstant distance between the two objects indicates to the technician whether or not fusion is taking place. A septum should be inserted in the stereoscope between the two oculars. Any attempt of the child to try to move his object over to the technician's side indicates suppression. Objects are used because they give the child the feeling of the difference between depth and a flat surface.

Fusion can be obtained on the stereoscope by using the Keystone or Wells slides and those which we have made ourselves (fig. 2). The Wells *B* cards have the additional advantage of giving the proper fusion distance, which can be determined when the patient tells the technician over which ball the arrow is pointing. The 3 *B* card measures the hyperphoria according to the stereoscope. Wells'[14] notation that hyperphoria frequently disappears as convergence power increases has been found true in several cases in our clinic.

Binocular single vision may be quickly recognized by the "FRIEND" test of alternately red and green letters. When this chart is viewed with the filters of complementary colors before the eyes of the child, one eye will see the word "FIN" in one color and the word "RED" in the other color. With good binocular vision the entire word FRIEND is seen in alternating green and red letters.

When fusion is obtained we give the child oscillation, flash the lights and put all sorts of obstacles in his way, in order to see whether the fusion is only temporary or whether it is becoming ingrained in his visual faculty. If he proves himself equal to these distractions and can hold the two objects, we start duction exercises.

Duction exercises can be accomplished with the synoptophore by pushing the arms from the position at which fusion is obtained to zero. Thus, in the case of convergent squint in which fusion takes place at 20 prism diopters on the synoptophore, there will be as great as possible divergence to zero, and in the case of divergent squint, convergence will be to zero. On the stereoscope duction exercises are accomplished by pushing two like cards of a set inward for adduction and outward for abduction. On the Keystone standard slides there is an exercise range of from 1 to 5 prism diopters, increasing to 10 prism diopters on the vision slides to the maximum of 33 prism diopters in the duction exercises.

Often a child who is unable to obtain fusion on the stereoscope with slides on which the fusion distances are fixed will do so when duction cards are used, because the angle of fusion can be varied to suit the patient's needs at the particular time. From this point duction can be

14. Wells, David: The Stereoscope in Ophthalmology, Boston, E. F. Mahady Co., 1926, p. 54.

gradually carried on so that it approaches more nearly the place where fusion would take place in the normal eye. Duction power, when accomplished, stimulates both the nervous and the muscular structures involved in the act. In normal cases the value should be about 24 prism diopters for the duction power of the internal rectus muscles and 8 prism diopters for that of the external rectus muscles. The child is induced to increase his convergence and divergence power as much as possible by making a game of it. At the clinic we have noticed that the child who has had training has gained an excess of duction power, so that he is able to fix with the good eye and turn the squinting eye in or out to approximately good cosmetic effect. Dobson [15] claimed that duction taken under stereoscopic conditions is always greater than duction taken with a flat target, and for this reason it is easier to bring about abduction under stereoscopic conditions; also, that abduction is easier between the ages of 3 and 6 years.

STEREOPSIS

Stereopsis is to be differentiated from perspective, which is not truly third dimensional. A person with good binocular single vision possesses stereopsis; a one-eyed man may be able to appreciate the portrayal of depth by the artist's excellent manner of dealing with perspective.

Stereopsis is evaluated by viewing each pair of Sattler cards; the reversal of these cards shows the reversal of depth. Some of the synoptophore transparencies have the same quality. Keystone cards also are valuable for this training by showing two seemingly identical cards with one of greater depth than the other (*F* series). With these cards one may sometimes be easily convinced as to whether or not the patient actually sees depth by asking several questions relative to the position of the various parts of the picture and by noting the patient's increasing interest in the lifelike character of the picture. Stereopsis is also shown on the Keystone cards by the vision slides and vergence cards 3 and 3 *A*. A check-up is offered by the back-drop slides of the Keystone series. In these the front of the picture shows stereopsis, and the back is painted on a drop curtain to show perspective. The Wells geometric cards are too complicated for children, but, curiously, the 10 *E* card sometimes has given satisfactory results.

Stereopsis is the most difficult of the three steps to obtain and, owing to its close association with perspective, is difficult to evaluate in the child. It is peculiar that some patients obtain it more readily on a difficult slide than on a simple one. Often one instrument is more efficacious than another in helping the child get stereopsis.

15. Dobson, Margaret: Binocular Vision and the Modern Treatment of Squint, New York, Oxford University Press, 1933.

TABLE 1.—*Results for One Year Only in Cured Patients* *

Name	Age, Years	Vision: Without Correction	Vision: With Correction	Type of Squint	Degree of Squint	Number of Visits	Results	Comment
E. G.	5	40-30	30-30	L C	15	38	F and S	Two degree squint
L. E.	11	20-30	20-20	R C	12	22	F and S	Stereopsis obtained in 17 lessons
C. M.	9	200-30	100-30	R D	10	39	F and S	Amblyopic vision improved to 30; retained at six months check-up
C. P.	14	70-20	40-20	Amblyopia, latent squint		13	F and S 20/20 vision	Vision retained after check-up
A. S.	10	70-70	20-20	R C	12	15	F and S	No visible squint with or without glasses
J. W.	9	50-50	40-40	R C	15	25	F and S	No visible squint
W. B.	7	20-20	20-20	L C	10	45	F and S	Excellent duction power
R. G.	13	20-30	20-20	L D	5	10	F and S	Eyes in good position; good duction power
A. K.	3	30?-30?	30?-30?	L C	10	29	F and S	Good result
R. V. H.	5	70-40	50-30	R C	12	24	F and S	20-20 vision

* In all the tables the following abbreviations are used: in indicating vision, the numerator is omitted when the distance from the patient to the chart is 20 feet; thus, 50-30 means 20/50-20/30. R means right; L, left; C means convergent; D, divergent, and Alt., alternating. F indicates fusion; S, stereopsis, and SMP, simultaneous macular perception.

TABLE 2.—*Data on Patients Showing Improvement Who Are Still Under Training*

Name	Age, Years	Vision: Without Correction	Vision: With Correction	Type of Squint	Degree of Squint	Number of Visits	Results	Comment
E. G.	13	70-20	30-20	L C	15	16	F	No stereopsis; eyes in good position
J. J.	6	30-200	20-200	L C	22	49	F and S	Three degrees of squint; vision improved to 20-40
F. C.	9	30-30	20-30	L C	17	25	F and S	Able to straighten eyes voluntarily
D. N.	5	30-30	30-30	Alt. C	15	53	F and S	Did not change glasses previously worn; eyes in good position
D. V. S.	8	20-200	20-200	R C, amblyopia	30	45	F and S	Operation; 3 degrees of squint; 20-70 vision
J. V. S.	10	20-100	20-50	L C	30	37	F and S	Operation; 3 degrees of squint
R. S.	5	40-20	30-20	Alt. C	15	40	F and S	Squint barely perceptible
J. D.	4	30-50	30-40	L C	10	56	Fuses most of time	Eyes appear in better position
J. B.	13	15/200-20	100-20	R C	26	66	F and S, S just beginning	Three degrees of squint; vision now 40-20
G. K.	10	70-30	30-30	Alt. C	30	70	Beginning F	Operation; 3 degrees of squint; tendency to use false macula
E. M.	9	1/200-20	200-20	R C	35	17	SMP, some F	Amblyopic vision, improved to 70; operation; 2 degrees of squint
H. N.	11	200-20	200-20	R C	12	50	F and S	Three degrees of alternating squint; overcame use of false macula; vision 70-20
G. J.	10	100-20	70-20	Alt. C	15	25	F	Five degrees of convergent squint
H. L.	13	30-30	30-30	Alt. D	15	15	F	Able to straighten eyes voluntarily
R. D.	5	20-100	20-70	L C	18	10	F	Overcoming amblyopia

TABLE 3.—*Data on Patients Showing Little Improvement Who Are Still Under Treatment*

Name	Age, Years	Vision: Without Correction	Vision: With Correction	Type of Squint	Degree of Squint	Number of Visits	Results	Comment
R. A.	6	30-30	30-30	Alt. C	30	29	F beginning	Operation; 5 degrees of squint
S. C.	9	100-20	50-20	L C	15	43	F	Overcame use of false macula
F. S.	5	20-40	20-40	L C	25	18	F	Beginning to use true macula
C. V. S.	7	20-20	20-20	Alt. C	35	10	F	
R. W.	4	70-70	70-70	Alt. C	10	21	F	
R. L.	5	30-30	30-30	Alt. C	15	24	F	Very irregular attendance; operation now advised
M. M.	10	20-200	20-200	R C	10	26	Some F	Uses false macula occasionally
R. J.	10	70-40	70-30	Alt. C	15	9	..	False macula; operation; 5 degrees of alternating squint
E. J.	9	200-40	200-20	R C	25	18	F (?)	Questionable false macula; congenital squint; operation; 5 degrees of right convergent squint
L. N.	9	70-70	30-40	L C	10	8	SMP	
J. S.	5	70-30	50-20	R C	7	3	Some F	Child beginning to be at ease during lesson

TABLE 4.—*Data on Patients Whose Treatment Was Discontinued on Our Recommendation* *

Name	Age, Years	Vision: Without Correction	Vision: With Correction	Type of Squint	Degree of Squint	Number of Visits	Comment
G. D.	3	.....	.....	Alt. C	10	2	Impossible to get any results; patient advised to return when older
C. G.	7	70-50	70-30	Alt. C	35	30	No improvement, even after operation
S. P.	7	20-30	20-20	Alt. C	5	17	No improvement; psychopathic
E. R.	7	20-20	.....	Alt. C	15	19	No improvement; irregular attendance; slow child
G. K.	13	40-40	30-30	Alt. C	40	19	No improvement; irregular attendance
D. K.	6	40-40—	30-30	Alt. C	35	14	No improvement; irregular attendance
M. S.	10	200-200	200-200	L D	5	12	Progressive myopia; condition little improved by training; irregular attendance
J. S.	3	.....	.....	Alt. C	15	6	Too young; to return in one year
H. D.	6	Not definitely obtainable		Alt. C	15	6	Backward child
M. G. E.	10	20-200	20-200	R C	10	18	No cooperation; irregular attendance
M. T. E.	5	100-70	70-50	Alt. C	35	20	Backward child
F. E.	6	30-40	30-40	Alt. C	35	14	No improvement; operation advised
E. W.	5	No vision obtainable		L C	5	9	Backward child
J. Y.	11	30-30	30-30	Alt. C	35	12	No improvement

* Thirty-seven patients taking 425 lessons dropped out of their own accord. Eight of these took only 1 lesson each. One (M. D.) took 20 lessons and was doing well; she left the clinic on account of her mother's death, as no one could bring her. R. P. took 32 lessons and left before official discharge, but was greatly improved. A. D. took 33 lessons, obtained stereopsis and left the clinic, as she had moved far away. H. F. obtained fusion and stereopsis. Thus these four improved but were not discharged; they took a total of 99 lessons.

CONCLUSIONS

It is difficult to arrive at a definite conclusion in so short a period, this being but the beginning of our second year in orthoptic training. However, we feel much encouraged by the great improvement shown in some cases of amblyopia ex anopsis, as seen in the cases reported in the tables. To derive the best results, it is absolutely essential to begin orthoptic treatment as early in life as possible in order to preserve central fixation, avoid retinal incongruity and make possible the use of maximum duction power.

Time can be saved by using Braun's method of classification as to retinal incongruity and rejecting the unsuitable cases. However, in view of the fact that this can be done only with older children and adults, possibly a better procedure will be to continue as we have and evaluate the condition in our cases after a period of several weeks of orthoptic training.

The number of patients whom we have treated thus far is insufficient to give a normal curve and hence does not merit stating accurate percentages; besides, many of our patients who are almost cured are not quite ready for discharge. However, to date our figures favor the conservative estimate as given by Guibor.[16] It is interesting to note that in group 1 of our tables there is a record of ten cures, with an aggregate of 260 lessons given and a combined angle of squint of 101 degrees, averaging 26 lessons to each patient whose average squint is 10 degrees. The greatest number of lessons given in any one case was 45, and the least number, 10. There was no alternating squint in this group. Table 2 deals with fifteen patients showing improvement but still under training. Seven of these are almost ready for discharge; in two the squint is alternating. Five hundred and seventy-four lessons were given. The total number of degrees of squint for this group is 305. In table 3 it is seen that eleven patients showed little improvement; 209 lessons were given. There is an aggregate angle of squint of 197 degrees. Seven of these patients are positively obtaining fusion; two occasionally obtain fusion, and one has simultaneous macular perception. There are five patients with alternating squint in this group. In the fourth and last group there are fourteen patients who have an aggregate angle of squint of 295 degrees. There are 11 patients with alternating squint in this group.

Orthoptic treatment is not to be considered a cure-all or a rapid cure, but it has its place in ophthalmologic practice as a conservative, painstaking remedial measure, productive of successful results in a certain number of cases in which refraction and operation do not fully yield binocular vision with its ultimate result, stereopsis.

16. Guibor, G. P.: Some Possibilities of Orthoptic Training, Arch. Ophth. **11**:450 (March) 1934.

TOXIC AMBLYOPIA DUE TO TOBACCO AND ALCOHOL

TREATMENT WITH VASODILATORS; A REPORT OF EIGHT CASES

FREDERICK C. CORDES, M.D.
AND
DAVID O. HARRINGTON, M.D.
SAN FRANCISCO

As early as 1896, de Schweinitz,[1] in his classic work on the toxic amblyopias, commented on the action of strychnine, amyl nitrite and nitroglycerin on amblyopia arising from the use of tobacco. He shrewdly remarked that strychnine, when administered during the inflammatory stage of a lesion of nerve tissue, e. g., ordinary peripheral neuritis, usually aggravates the disorder but is beneficial in axial optic neuritis caused by tobacco poisoning. He suggested that this might be a therapeutic test proving that vascular change and not inflammation is the early underlying pathologic process in the optic nerve in simple tobacco amblyopia.

Somewhat later, Parsons,[2] after making a careful study of the pathologic changes in the toxic amblyopias, reviewed the various hypotheses of the action of tobacco or nicotine on the retinal cells and synapses and discarded Fisher's theory that such action directly affects the cells. He cited Holden's [3] work on the pathologic changes found in experimental poisoning by quinine, emphasizing the vasoconstrictive action of the drug, and further pointed out that tobacco or nicotine is an even more powerful vasoconstrictor than quinine. He therefore thought that the prime factor in the production of amblyopia due to tobacco was the vasoconstrictive action of the tobacco, mainly because of the already poor blood supply of the macular region. A secondary action was paralysis of the synapses of the cone fibers or cone bipolars or of both.

Wood,[4] Armaignac,[5] Ray,[6] Black,[7] Dinkelspiel [8] and others have attested to the beneficial effects of strychnine and digitalis in toxic

---

From the Division of Ophthalmology, Department of Surgery, University of California Medical School, San Francisco.

1. de Schweinitz, G. E.: The Toxic Amblyopias, Philadelphia, Lea Brothers & Co., 1896, p. 91.

2. Parsons, J. H.: Pathology of Toxic Amblyopias, Ophth. Rev. **20**:181, 1901.

3. Holden, W. A.: Pathology of Experimental Quinine Blindness, Tr. Am. Ophth. Soc. **8**:405, 1898.

4. Wood, C. A.: Toxic Amblyopias: Symptoms, Varieties, Pathology and Treatment, Ann. Ophth. & Otol. **1**:123, 171 and 253, 1892; **2**:237, 1893; **3**:77, 276 and 381, 1894.

(Footnotes continued on next page)

amblyopia. The drugs, however, were given on a purely empirical basis. More recently, Pflimlin,[9] Duggan [10] and Turtz [11] used vasodilators in the form of sodium nitrite in twenty-three cases of amblyopia due to tobacco and alcohol, with almost uniformly good results. Numerous authors have reported observations on the blood pressure of patients with toxic amblyopia and have attributed the amblyopia to vascular changes. Others have noted the relation between Buerger's disease and the consumption of tobacco. Maddock and Coller [12] and Barker [13] found a definite vasoconstrictive effect of tobacco; the former demonstrated this by changes in the temperature of the skin.

Pflimlin, who reported fifteen cases of toxic amblyopia in 1930, found a systolic blood pressure of 180 mm. of mercury or more in the majority of his patients. He suggested that arterial spasm is an important factor in the development of such amblyopia and treated his patients with intravenous injections of a vasodilating agent consisting of inorganic salts, among which is sodium nitrite, in an isotonic solution of sodium chloride. All his patients improved. Fifteen of the thirty eyes treated obtained vision of 20/30 after the use of an average of twelve injections over a period of five and two-tenths weeks. The rapidity of improvement or cure was the outstanding feature in all the cases. He believed that abstinence alone is not sufficient to effect a cure or even much improvement in many of the long-standing cases. One of his patients improved under treatment with the aforementioned vasodilating agent in spite of the continued use of tobacco and alcohol.

---

5. Armaignac, H.: Amblyopie nicotinique rapidement guérie par la suppression du tabac et les injections hypodermiques de strychnine, Rev. clin. d'ocul., Paris **8**:55, 1887.

6. Ray, J. M.: Three Cases of Tobacco Amblyopia Showing Results Gained by Hypodermic Injections of Strychnine, South-West M. Gaz. **1**:262, 1887.

7. Black, J.: Strychnine Nitrate in Toxic Amblyopia from Alcohol and Tobacco, New York M. J. **54**:287, 1891.

8. Dinkelspiel, M. R.: Digitalis in Treatment of Tobacco Amblyopia, New York M. J. **117**:639, 1923.

9. Pflimlin, R.: Die Behandlung der Alkohol-Tabaksamblyopie mit Nitroskleran, Klin. Monatsbl. f. Augenh. **85**:787 (Dec.) 1930.

10. Duggan, W. F.: Treatment of Toxic Amblyopia with Vasodilators, Arch. Ophth. **8**:304 (Aug.) 1932.

11. Turtz, C. W.: Toxic Amblyopia—Treatment with Vasodilators, J. Am. Inst. Homeop. **26**:511, 1933.

12. Maddock, W. G., and Coller, F. A.: Peripheral Vasoconstriction by Tobacco Demonstrated by Skin Temperature Changes, Proc. Soc. Exper. Biol. & Med. **29**:487 (Jan.) 1932; Peripheral Vasoconstriction by Tobacco—Relation to Thrombo-Angiitis Obliterans, Ann. Surg. **98**:70, 1933.

13. Barker, N. W.: Vasoconstrictor Effects of Tobacco Smoking, Proc. Staff Meet., Mayo Clin. **8**:284, 1933.

Duggan, in 1932, reported six cases of toxic amblyopia in which the patients were treated with daily intravenous injections of a compound solution of sodium nitrite. On each of the first three days 40 mg. of the sodium nitrite solution was given. For the remaining injections 100 mg. a day was used. From six to fifteen injections were given. Eight of the twelve patients obtained vision of 20/30 or better within from three to fourteen days. Two eyes required five weeks to obtain maximum improvement. Two eyes remained unchanged. The visual fields showed correspondingly rapid improvement in the scotomas.

Turtz, in 1933, outlined the classic treatment, consisting of abstinence, purgation and the administration of potassium iodide and strychnine, and remarked on the long interval between the beginning of treatment and the first evidences of improvement. He reported the cases of two patients who were treated with sodium nitrite by intravenous injection; in one vision improved from 5/200 to 20/20 within ten days, and in the other, from 20/200 to 20/30 after twelve injections.

Traquair [14] and Gunn,[15] on the other hand, maintained that tobacco does not exert its primary effect on the vascular system but rather poisons the nerve cells. In the opinion of these authors, the presence of arteriosclerosis and hypertension are of importance only so far as they affect the general resistance of the patient to toxic absorption.

During a recent visit to the clinic of Doctor Traquair in Edinburgh, one of us had occasion to note the relatively large number of patients with tobacco amblyopia seen each month and the splendid opportunity which Doctor Traquair has for studying such patients. It is difficult to discover why the condition should be so much more common in Scotland than in America. One wonders whether the greater incidence is due to the type of tobacco smoked and to the fact that the Scotch are a nation of pipe-smokers, while Americans are primarily smokers of cigarets, or whether there is a national sensitivity to poisoning by tobacco. By far the majority of the cases seen were those of pure tobacco poisoning, and definite systolic hypertension was frequently recorded.

Whether tobacco acts as a vascular or nerve poison is apparently, from the material just cited, still a much disputed question. From the point of view of therapeutics, however, there can be no doubt that, of all the drugs tried, only those having a direct effect on the circulation have been of any definite benefit.

The following eight cases bear this out most strikingly, not only by the end-results obtained but more particularly by the rapidity of recovery from amblyopia, even in severe and long-standing cases.

---

14. Traquair, H. M.: Toxic Amblyopia, Including Retrobulbar Neuritis, Tr. Ophth. Soc. U. Kingdom **50**:372, 1930.

15. Gunn, J. A.: Toxic Amblyopia, Tr. Ophth. Soc. U. Kingdom **50**:391, 1930.

METHOD OF TREATMENT

Whenever possible, a general physical examination of each patient was made before treatment was instituted. One patient was under treatment for severe diabetes; one had a blood pressure of 170 systolic and 80 diastolic in millimeters of mercury, and two showed a rather severe degree of retinal arteriosclerosis without hypertension.

Six of the eight patients received daily subcutaneous injections of a vasodilating agent consisting of inorganic salts, among which is sodium nitrite, in an isotonic solution of sodium chloride. The dose was 100 mg. in 1 cc. of the solution and the number of injections was determined entirely by the patient's response. One patient received twelve subcutaneous injections of the sodium nitrite solution and then, because of inability to report for daily injections, was given 1.5 grains (0.09 Gm.) a day of erythrol tetranitrate by mouth. The eighth patient received only erythrol tetranitrate by mouth.

The only evidence of a disagreeable effect of these drugs was a complaint by one patient of attacks of abdominal pain coming on shortly after the ingestion of a tablet of erythrol tetranitrate and lasting for from one half to three quarters of an hour and by another of headache following the ingestion of such a tablet.

There is no reason why these particular vasodilating drugs should be preferred to any others. It is probable that amyl nitrite would prove equally successful. Nitroglycerin in proper doses has already been referred to as being of benefit. These drugs are somewhat quicker in their action on the vessels but have the disadvantage of exerting their effect over a much shorter time.

All the patients were cautioned as to abstinence from tobacco and alcohol but were told that, if they wished, they might smoke from four to six cigarets a day. The majority preferred to discontinue the use of tobacco and alcohol completely.

REPORT OF CASES

CASE 1.—J. R., a man, aged 80, was seen first on March 20, 1934, when he complained of gradual loss of vision of two or three years' duration, with rapid loss within the past six months. He had had severe diabetes for many years, which had been controlled by diet and insulin for the past three months. He smoked eight or ten Italian cigars a day but used no alcohol. Vision in each eye was 2/200 both with and without correction.

Examination showed clear media and fundi which were essentially normal. There was no evidence of optic atrophy. The visual fields showed typical dense paracentral scotomas, extending from the blindspot to the fixation point. Examination was made on the Bjerrum screen at 1 meter with a 2 mm. white test object. The color fields were completely gone, except for a slight field for blue on the nasal side (fig. 1).

The patient was advised to discontinue the use of tobacco completely, which he did. He then was given a series of eighteen subcutaneous injections of 0.1 Gm. of sodium nitrite over a period of twenty-six days.

At the end of ten days vision of the right eye had increased to 20/200, and that of the left eye was 10/200. The paracentral scotomas were definitely less dense.

By the end of twenty-six days and after eighteen injections of sodium nitrite vision had improved to 20/100 in the right eye and 20/200 in the left. The paracentral scotomas had diminished in size so that they no longer included either the blindspots or the central fixation area (fig. 2).

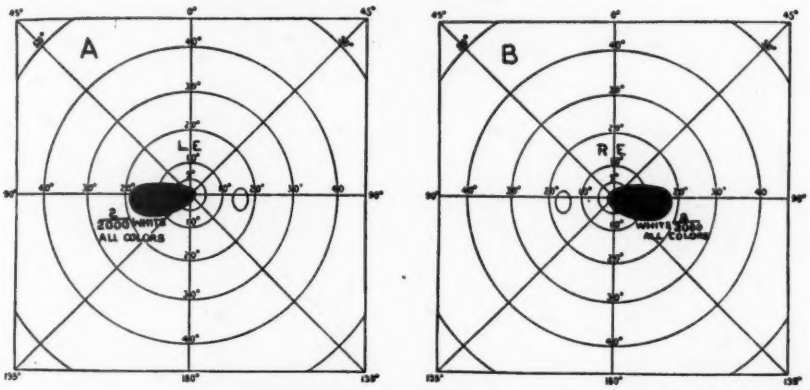

Fig. 1 (case 1).—Left field (*A*) and right field (*B*), taken March 20, 1934, showing large, dense paracentral scotomas. The fields were taken at 2 meters with a white object and objects of all colors 2 mm. in size.

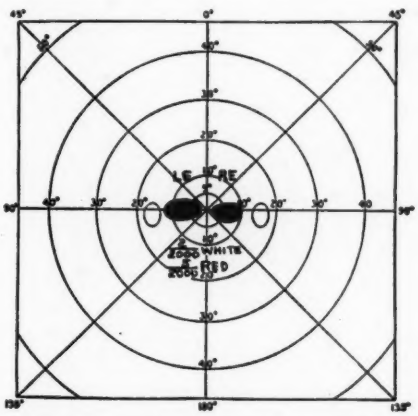

Fig. 2 (case 1).—Fields of both eyes, taken April 16, 1934, after eighteen injections of sodium nitrite solution. The fields were taken at 2 meters with a 2 mm. white object and a 5 mm. red object.

Treatment was then discontinued and the patient was observed for two weeks, during which time vision of the left eye improved to 20/100. The scotomas, however, remained the same.

Another series of six injections of sodium nitrite was given, and vision improved during one week to 20/70 in each eye, with a corresponding decrease in the size and density of the scotomas.

This procedure was continued for three more weeks, with an alternate week of treatment with sodium nitrite and a week with no treatment but abstinence. It was noticed that when the injections were discontinued improvement ceased. Finally, after seventy days, during which time thirty injections of sodium nitrite had been given, visual acuity of 20/30 was obtained in each eye. The central fields, taken at 1 meter with a 1 mm. white object, showed only a small, relative defect 5 degrees temporal to the point of fixation.

CASE 2.—A. N. D., a man aged 58, was seen first on June 8, 1934. He stated that during the previous week colors had seemed lighter and less definite than normally and vision in general was diminished somewhat. He smoked from six to eight cigars and eight or ten cigarets daily and drank one or two cocktails every evening.

Central vision was 20/30 in each eye but was rather dim and cloudy.

Examination of the eyes gave essentially negative results, except for rather definite retinal arteriosclerosis.

Fields taken at 1 meter on the Bjerrum screen showed a typical paracentral scotoma on the right, extending from the blindspot nasally to within 1 degree of the fixation point. The left field showed only a minute island-like defect midway between the blindspot and the point of fixation.

The patient was advised to abstain from smoking cigars and was given a subcutaneous injection of 100 mg. of sodium nitrite.

The next day the scotoma in the left field had cleared completely, and that in the right field had decreased greatly in size and density. The patient's vision had improved also, and it was possible to take a color field with small objects. This showed rather definite bilateral paracentral scotomas.

A series of six injections of sodium nitrite was given over a period of ten days, at the end of which time vision had improved to 20/20 in each eye; colors were much clearer, and examination of the fields with a 1 mm. white object and a 3 mm. red object, at 1 meter, failed to show any defect.

CASE 3.—C. C., a man aged 44, was seen first on May 21, 1934, when he complained of blurred vision of about two weeks' duration, with a "spot before the right eye." He smoked from ten to twenty cigarets a day and had eight or ten drinks of Scotch whisky a day.

Vision in each eye was 20/20 with correction of a moderate refractive error. Examination of the fundi gave entirely negative results.

The visual fields were taken on the Bjerrum screen with 1 mm. white and colored objects at 1 meter, and typical bilateral paracentral scotomas of amblyopia due to tobacco and alcohol were found. The condition of the right eye was worse than that of the left.

The patient was advised to discontinue the use of alcohol and tobacco completely and to take three 5 grain (0.3 Gm.) tablets of erythrol tetranitrate a day by mouth.

Three days later he returned, having taken ten tablets of the vasodilator. His vision had improved subjectively; examination of the fields showed no demonstrable scotoma on the left and a small relative, paracentral scotoma for a 1 mm. white object at 1 meter on the right.

Ten days after the first visit the patient was discharged with only a small relative scotoma for a 1 mm. object at 1 meter on the right.

CASE 4.—N. A., a man aged 29, was seen first on March 27, 1934, when he complained of dimness of near and distant vision of six months' duration. He smoked from four to six Italian cigars a day and drank about 1½ quarts (1.4 liters) of red wine daily.

General physical examination gave essentially negative results. The blood pressure was 112 systolic and 70 diastolic.

Examination of the eyes showed vision of 20/50 in each eye, with correction. External examination showed nothing abnormal. The media were clear, and the fundi were entirely normal.

Examination of the visual fields showed typical bilateral paracentral scotomas of tobacco amblyopia (fig. 3).

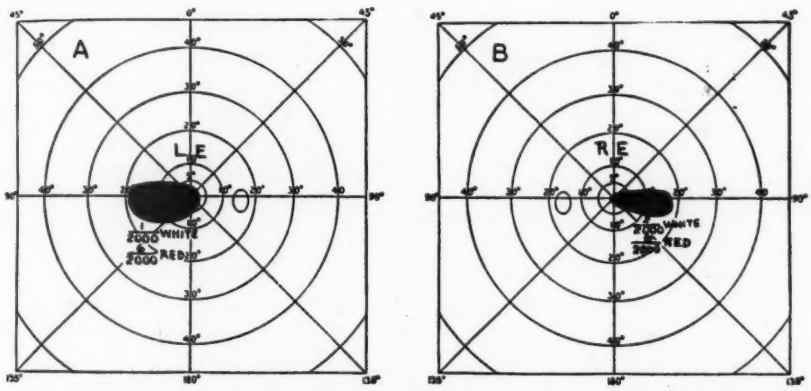

Fig. 3 (case 4).—Left field (*A*) and right field (*B*), taken March 24, 1934, before treatment. The left field was taken at 2 meters with a 1 mm. white object and a 6 mm. red object; the right field was taken at 2 meters with a 2 mm. white object and a 6 mm. red object.

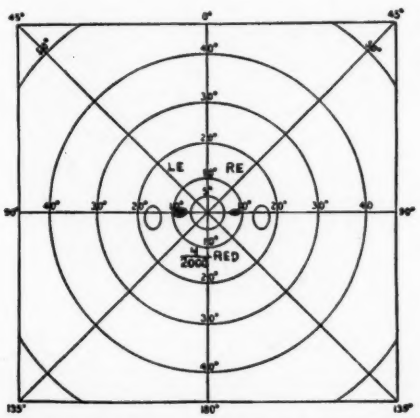

Fig. 4 (case 4).—Fields of both eyes, taken April 16, 1934, after six injections of sodium nitrite. The fields were taken at 2 meters with a 4 mm. red object.

The patient was advised to cut down the amount of tobacco consumed to four or five cigarets a day and the amount of alcohol to one glass of wine a day. He was given a subcutaneous injection of 0.1 mg. of a solution of sodium nitrite. Twenty-four hours later, vision had improved to 20/30 in both eyes, and the scotomas were definitely less dense.

After six daily injections of sodium nitrite, vision was 20/20 in each eye, and the scotomas were present only for 4 mm. red objects at 2 meters (fig. 4).

CASE 5.—J. C., a man aged 68, was seen first on March 9, 1934, when he complained of gradual loss of vision in both eyes of one year's duration. He had had two changes of glasses without relief. He smoked approximately 1 ounce of heavy pipe tobacco a day.

General medical examination showed rather marked peripheral arteriosclerosis, with some pallor of the optic disks. The intra-ocular tension was 20 (McLean).

The visual fields, taken at 2 meters with 2 mm. white and 6 mm. red objects, showed the dense, bilateral paracentral scotomas typical of tobacco amblyopia.

Vision was 8/200 in the right eye and 20/200 in the left without correction; this improved to 20/200 in each eye with correction.

The patient was advised to discontinue the use of tobacco completely and to report again in three weeks.

On March 27, vision and the fields were the same as at the first examination. The patient was then given a series of eighteen subcutaneous injections of a solution of sodium nitrite, extending over a period of three weeks. After two injections vision had improved to 20/200 in the right eye and 20/70 in the left, without correction. After eighteen injections vision had increased to 20/100 in the right eye and 20/40 in the left, and with correction it was 20/30 in each eye. The fields showed marked diminution in the size and density of the scotomas.

The patient was observed at intervals for some time, and twelve more injections of sodium nitrite were given over a period of six weeks, but no additional improvement was noted, other than a very gradual shrinking of the scotomas in both eyes.

CASE 6.—M. C., a man aged 53, first visited the clinic on April 7, 1934, when he complained of failing vision of two months' duration. He smoked twenty cigarets and three or four Italian cigars and drank four or five glasses of red wine daily.

General physical examination gave essentially negative results. The blood pressure was 105 systolic and 85 diastolic.

Examination of the eyes showed no abnormalities except bilateral paracentral scotomas, which were elicited on the Bjerrum screen with a 2 mm. object at 2 meters. The scotoma on the right was denser than that on the left.

Vision was 20/200 in the right eye and 20/70 in the left, both with and without correction.

The patient was advised to discontinue smoking and drinking.

Two weeks later, as vision and the fields remained the same, the patient was given a subcutaneous injection of sodium nitrite. Within twenty-four hours vision had improved to 20/100 in the right eye and 20/50 in the left. A series of twelve injections was then given over a period of fourteen days, at the end of which time vision had improved to 20/20 in each eye, with correction, and the scotomas had decreased definitely in size and density.

A total of eighteen injections of sodium nitrite solution, given over a period of one month, sufficed to abolish the paracentral scotomas, and vision remained 20/20 in each eye.

CASE 7.—S. P., a man aged 65, first visited the clinic on April 18, 1934, when he complained of poor vision of ten years' duration in the right eye and of three years' duration in the left. For years he had smoked from ½ to ¾ ounce (14 to 21 Gm.) of strong, black Italian pipe tobacco a day.

General physical examination gave essentially negative results, except for a blood pressure of 170 systolic and 80 diastolic.

Examination of the eyes showed some retinal arteriosclerosis; the disks were pale, with rather deep temporal cups. Tension was 40 in both eyes (McLean). Vision was 2/200 in the right eye and 5/200 in the left, with correction.

The visual fields, taken at 2 meters with 20 mm. objects, showed bilateral dense, paracentral scotomas.

The patient was advised to discontinue completely the use of tobacco, and a series of twelve subcutaneous injections of sodium nitrite solution was given over a period of five weeks. At the end of this time vision had improved to 10/200 in the right eye and 20/100 in the left, and the scotomas had been reduced markedly in size and density.

Because the patient lived in the country, he was given some tablets of erythrol tetranitrate to take at home. Further observation has been impossible because of the distance to be traveled to the clinic.

CASE 8.—L. M., a man aged 60, came to the clinic on June 6, 1934, when he complained of poor vision of about nine months' duration. He smoked two or three Italian cigars and two or three pipefuls of tobacco and drank about a quart (946 cc.) of wine daily.

General examination revealed marked pneumonoconiosis, a large liver and a blood pressure of 150 systolic and 100 diastolic with atherosclerosis of the thoracic aorta. Vision was reduced to 5/200 in each eye and was unimproved by lenses. The corneas, lenses and media were clear. There were rather marked arteriosclerotic changes in the retinal vessels and a slight pallor of the optic disks. The tension was 40 (McLean) in both eyes.

The visual fields, taken on the Bjerrum screen with a 6 mm. object at 2 meters, showed the typical bilateral paracentral scotoma of toxic amblyopia due to tobacco and alcohol.

The patient was advised to discontinue the use of tobacco and alcohol completely and was given daily subcutaneous injections of sodium nitrite solution for twelve days. At the end of this time his vision had improved slightly (to 8/200 in each eye) and the paracentral scotomas had definitely decreased in size. The patient lived at some distance from the clinic and was given erythrol tetranitrate to be taken at home, 1½ grains (0.09 Gm.) daily. After two weeks vision improved to 20/200 in the right eye and 20/100 in the left, with a definite decrease in both the size and the density of the paracentral scotomas.

SUMMARY AND CONCLUSIONS

The question of vascular spasm as an etiologic factor in tobacco and alcohol amblyopia has been considered seriously for many years, and numerous authors have advocated vasodilating drugs in its treatment.

More recently, reports of cases in which tobacco and alcohol amblyopia was treated with sodium nitrite have appeared. The results have been uniformly gratifying.

Eight cases are reported in which vasodilating drugs were used. Some of these were well advanced cases in which the prognosis was rather poor. In every case there was much more rapid improvement in vision than would have been expected with abstinence alone. In some cases the amount of visual improvement was almost as remarkable as its rapidity.

As a therapeutic test, the results obtained with these drugs seem to substantiate the argument that tobacco is a vasoconstrictor and that the

primary etiologic factor in amblyopia due to tobacco and alcohol is spasm of the blood vessels.

We believe that the vasodilating drugs deserve a place in the ophthalmologic pharmacopeia. They are of definite value in the treatment of the toxic amblyopias caused by tobacco and alcohol, accomplishing in many cases remarkably rapid and complete return of vision.

Clinical Notes

ORBITAL ABSCESS (FOLLOWING FOREIGN BODY OF ORBIT) AND MENINGITIS WITH RECOVERY

MONTE F. MEYER, M.D., AND JEANNE C. ROELING, M.D.,
NEW ORLEANS

A case history of orbital abscess resulting from foreign body in the orbit is reported, as this condition occurs infrequently at Charity Hospital despite the large number of patients treated for diseases of the eye. Furthermore, this case exemplifies the difficulty in diagnosing the presence of a nonopaque foreign body. Even the roentgenogram is of no value in such cases. Although probing of the external wound was done at the time of admission, the foreign bodies in this case were located only during enucleation.

REPORT OF A CASE

History.—P. D., a boy, was found unconscious by his parents after a fall which occurred while he was playing alone. After approximately fifteen minutes, he regained consciousness and showed no evidence of injury except that the left eye began to show signs of trauma. It was assumed that he probably had struck his eye on a box which was nearby, and he was immediately brought to the hospital. While awaiting admission, the patient again lost consciousness for approximately ten minutes. He was perfectly well prior to the accident.

Physical Examination.—A well developed white boy of 10 years, who was acutely ill, gave almost completely negative results on physical examination. The left eye showed marked ecchymosis, proptosis and conjunctival chemosis. The pupil was dilated and did not react to light or in accommodation. No motility of the eyeball was present in any direction. A small laceration of about 1 inch (2.5 cm.) was present in the region of the inner half of the left eyebrow. Examination of the fundi showed that the optic disks were pink and the blood vessels of normal caliber. The fundi were essentially normal.

Progress.—A tentative diagnosis of cerebral concussion and contusion of the left eye was made.

Recovering from unconsciousness in the admitting room, the patient remained rational for approximately nine hours, at which time he became comatose and the temperature rose to 103 F. A diagnostic spinal puncture within twelve hours of admission yielded fluid which showed a cell count of 950 white cells (95 per cent polymorphonuclears) and was under a pressure of 20 mm. of mercury. The smears showed an organism which morphologically was Bacillus pyocyaneus.

The next day, the general condition was still poor, and the comatose state persisted. The pressure of the spinal fluid was 14 mm. of mercury, and the fluid was still cloudy. Routine treatment for meningitis was begun, exclusive of the use of serum. Warm compresses of boric acid were applied to the eye.

The patient rapidly grew worse, and nasal feedings were begun. The cell count of the spinal fluid rose to 3,000 (the fluid was under a pressure of 30 mm. of mercury), although no organisms were found. Orbital cellulitis was still present.

By the fifth day, the cell count of the spinal fluid had reached a peak of 4,000. The temperature now ranged from 100 to 100.7 F.

The cell count of the spinal fluid fell to 1,000 by the end of the first week, but the general condition of the patient failed to improve. The pulse became irregular, owing to an occasional dropped beat. During this time the optic atrophy was progressing, although orbital abscesses could not be definitely diagnosed.

Slight improvement was evident on the ninth day, so no lumbar puncture was performed. Hyperpyrexia recurred during the night, and the patient was exceedingly restless. The orbital cellulitis remained stationary, although optic atrophy was almost complete. The possibility of a foreign body in the orbit was reconsidered (although there was no history of one), as well as that of cavernous sinus thrombosis. After careful consideration, it was deemed advisable to perform an enucleation to explore the cavernous sinus.

During the operation, a piece of wood (0.5 by 0.5 by 3 cm.) was removed from the orbit. Little trauma was used, and only a little exploration was done, owing to the poor condition of the patient. A drain was inserted in the wound. On removal of the drain, in approximately forty-eight hours, another splinter of wood of one-half the size of the first was removed. A small amount of serosanguineous discharge was obtained from the wound. A blood culture taken on this day showed Staphylococcus (hemolytic) albus. It is questionable whether or not the presence of this organism was due to contamination.

During the second week, the patient remained afebrile. Only one spinal puncture was done, which showed hemic fluid under normal pressure. Much purulent drainage was now obtained from the orbit.

An abscess of the upper part of the right arm developed during the third week. In about four days, the orbital abscess ceased draining, and a toxic psychosis developed. After drainage was reinstituted, the patient recovered and was up and about during the fourth week of his illness.

Profuse orbital drainage continued for approximately two months. The general condition of the patient afterward was excellent. The only residual was ptosis of the left upper lid.

COMMENT

Several facts are of interest in this case. First, there was lack of evidence of the presence of a foreign body, with the exception of the small laceration in the upper lid. Second, although fracture of the orbit was possible, none was demonstrable. Third, the patient was moribund and recovered. A definite meningitis was present, as shown by a cell count of the spinal fluid, which rose to 4,000 and by the presence of an organism identified as B. pyocyaneus.

It is generally accepted that this organism rarely occurs as a primary invader, but the infections are acute and fatal almost without exception. The organism has a predilection for lymphatic tissue and rarely infects the meninges. In the few cases of B. pyocyaneus meningitis reported, the disease in the majority of instances has followed a recognizable cause, such as trauma or lumbar puncture, or has occurred in association with generalized infection, such as septicemia. Good results have been obtained in treating the patients by decompression. This patient recovered without the aid of serums, only repeated lumbar punctures being used together with removal of the focus.

BACILLUS PYOCYANEUS KERATITIS

Report of Three Cases

HARRY A. SHEARER, M.D., BELOIT, WIS.

The following report deals with three cases of infection of the cornea by Bacillus pyocyaneus seen over a twelve day period. The patients came from the shops of a large industrial corporation of the Central West. During the period there were two hundred and forty cases of minor injuries of the eye, all of them similar to those in which the pyocyaneus infection developed. The typical features in each case were: the lodgment of a foreign body in the eye, mild irritation of the conjunctiva with slight blurring of vision, moderate pain, epiphora and photophobia. All of the patients were given the same treatment, namely, removal of the foreign body followed by instillation of 20 per cent mild silver-protein and irrigation with boric acid. In several instances in which the foreign body had been in the eye over a longer period of time and the eye showed definite injection, a 2 per cent atropine ointment was applied, the eye dressed and the injured person sent home with instructions to bathe the eye with a warm solution of boric acid and to report the following day for observation.

CASE 1.—F. O., a man, aged 32, whose physical examination gave negative results, appeared at the shop hospital with a history of having had a foreign body in the eye overnight. Marked photophobia and epiphora with decided circumcorneal injection were present. A small foreign body was removed from the cornea in a fragmenting state. The eye was atropinized, and the patient was sent home. Severe pain, preventing sleep, and an ulcer measuring about 2 mm. in diameter developed in the succeeding twelve hours. The cornea was stained, the ulcer was cleaned and touched with silver nitrate and the patient was hospitalized. The ulcer progressed rapidly during the next forty-eight hours till it involved the entire cornea; hypopyon developed; there was a slight cessation of symptoms for twenty-four hours, and then perforation of the cornea and panophthalmitis occurred. Evisceration was done on the eleventh and enucleation on the twenty-sixth day, after which recovery was rapid and uneventful. The temperature varied from 98 F. on the patient's admission to the hospital to 99.2 F., and on the sixth day it reached 102.4 F. It immediately receded to 98 F. following perforation, but showed a gradual increase each day till the twelfth day, when it reached 100 F., it again receded to from 98 to 99 F. following evisceration. The average white blood cell count was 12,200. At no time was the eye free from pain or the patient from headaches until after enucleation. Smears taken from the conjunctival sac during the progress of the development of the ulcer showed gram-negative single bacilli and diplobacilli.

CASE 2.—G. C., a man aged 28, whose general physical examination gave negative results, reported to the shop hospital about eighteen hours following an injury. A small foreign body was removed, and the patient was sent home. About twelve hours later he had severe pain in the eye, marked photophobia and epiphora. Staining with fluorescein revealed a central ulcer measuring about 3 mm. in diameter. The ulcer was cauterized and the eye treated with atropine, and the patient was hospitalized. The ulcer progressed rapidly, covering the cornea in approximately four days. Paracentesis was performed with reduction of the ten-

sion and relief of pain for about twenty-four hours. The eye was removed on the twelfth day. Recovery was rapid and uneventful. Repeated smears taken from the eye showed the presence of gram-negative single bacilli and diplobacilli. A culture of material secured by passing a sterile swab over the surface of the conjunctiva gave a growth of pure Staphylococcus albus. Scrapings from the eye showed no organisms. The culture yielded a pure growth of a gram-negative bacillus. Cultural reactions and the formation of pigment showed the organism to be B. pyocyaneus.

CASE 3.—C. K., a man aged 42, whose general physical examination gave negative results, reported to the shop hospital with a history of having had a foreign body in the eye for about twelve hours. The foreign body was removed and the usual treatment given. He was seen daily for four days, during which period there was no severe pain, though there were injection and slight photophobia. On the fourth day severe pain developed in the eye with marked exaggeration of all the symptoms. The ulcer was cauterized and the eye treated with atropine, and the patient was hospitalized. The eye was removed on the twelfth day. The progress was similar to that in the aforementioned cases, and the patient had a similar temperature curve. The white blood cell count was 11,150. Smears showed much pus but no organisms. Culture material was secured by removing pus which had accumulated between the lids and the eyeball. Cultures made on blood agar produced a pure growth of a gram-negative bacillus which had the morphologic characteristics and staining reaction of the organism growing on Löffler's blood serum. A culture which was secured by scraping the tissue over the ulcer and planting the scrapings on Löffler's blood serum produced a pure growth of a gram-negative bacillus which morphologically and in staining reactions was like the organism seen in the culture of the pus. The cultural reactions and formation of pigment showed the organism to be B. pyocyaneus.

The outstanding similarities in the three cases observed are: (1) the presence of a foreign body on the cornea for a period of from twelve to eighteen hours; (2) the sudden and severe attack and the rapid extension of the ulceration; (3) the resistance of the invading organism to treatment which included the use of the usual antiseptic drugs, atropine, phenol and silver nitrate, the thermophore and the cautery; (4) comparative freedom from high temperature and relatively high leukocytosis.

All attempts to locate the organism in the factory in iron dust, air blowings, water, oil washes, soaps, solutions and medicaments were unsuccessful.

Ophthalmologic Review
EDITED BY DR. FRANCIS HEED ADLER

OCULAR DOMINANCE

L. F. McANDREWS, M.D.
PHILADELPHIA

Claude Bernard once wrote: "We are surrounded by phenomena which we do not observe." This is well exemplified by the fact that the unequal function of the two eyes in binocular vision is not commonly known or recognized. One knows that if one fixes both eyes on an object all other objects in front of or behind this object should appear double. Actually this is not the case, because one suppresses one of these images, and in the case of most persons it is the image of the left eye. For this reason the right eye is said to be the dominant eye.

Although a human being is born with two eyes which act as a single unit, one assumes the rôle of the dominant or master eye. In cases in which vision is lowered by disease or refractive error, this fact is self-evident. But in cases of approximately equal visual acuity in the two eyes ocular dominance can be shown in the majority of persons. Duke-Elder stated that binocular vision in man can be acquired only after birth. It is not until the sixth week that the infant can fix both eyes on a light.

The process by which this faculty is acquired is shown in all conditioned reflexes. This was clearly shown by the work of Pavlov. Fusion, therefore, may be considered as the result of education. All ophthalmologists have noted that in testing with the Maddox rod the image of the red line of light appears much dimmer than the point of light. If a special effort is made, the red line can be seen simultaneously with the much brighter image of the point of light.

It was on the basis of these tests that Helmholtz made the following statement:

> Experiments show that man possesses the faculty of perceiving the image in each eye separately, without being disturbed by those in the other eye, provided he can concentrate his whole attention on the subject in this one field. This is an important fact because it signifies that the content of each separate field comes to consciousness without being fused with that of the other field by means of organic mechanisms and that therefore the fusion of the two fields into one common image, when it does occur, is a psychic act.

This fact is utilized to show ocular dominance A common test is the one based on physiologic diplopia: A distant object is sighted, and a pencil is held fairly close to the eye so that a double image is formed; the image which is more vivid and which does not move is that of the master eye.

The first reference to ocular dominance appears in the writings of Humphrey in 1861 and in a short article by Callan [1] in 1881. Rosenbach [2] and Wray [3] deserve the credit for bringing this matter to the attention of ophthalmologists in the same year (1903). Since the World War several studies have been made on this subject.

Rosenbach carried out his test in this way: The patient is asked to sight a distant, perpendicular object with both eyes open. He then is told to place his right index finger in line with this object, between the object and his eyes. Usually the side of a picture or door is selected. The left eye is closed, and the patient observes that the finger does not move to either side but remains in line with the distant object. The right eye is then closed, the left eye being kept open. The finger is then seen to have moved to the right of the object and is no longer in line with it. These experiments were carried out on right-eyed and right-handed persons. Most of the tests which have since been invented utilize this principle. Some authors have criticized this test, asserting that the hand used in the test determines the dominance of the eye. For this reason they have devised tests in which the hands are not employed. However, this is not a serious objection, for the results are the same, even if both index fingers are used to sight the distant object at the same time.

The studies of Mills,[4] Parson,[5] Miles,[6] Engeland,[7] Baudouin,[8] Hillemanns,[9] Esser,[10] Stern,[11] Ludwig [12] and others have shown that more than 75 per cent of all human beings are right-eyed and right-handed; 23 per cent are left-eyed, and in about 2 per cent ocular dominance is indifferent or distributed between the two eyes. Practically all right-eyed persons are right-handed. In the case of left-eyed persons this

1. Callan, P. A.: Are We Right Sighted? M. Rec. **1**:390, 1881.

2. Rosenbach: Ueber monoculare Vorherrschaft beim binocularen Sehen, München. med. Wchnschr. **30**:1290, 1903.

3. Wray: Righthandedness and Leftbrainedness, Lancet **1**:683, 1903.

4. Mills, L.: Eyedness and Handedness, Am. J. Ophth. **8**:933, 1925.

5. Parson, B. S.: Lefthandedness, New York, The Macmillan Company, 1924.

6. Miles: Ocular Dominance in Human Adults, J. Gen. Psychol. **3**:412, 1930.

7. Engeland, R.: Ueber funkionelle Asymmetrie, München. med. Wchnschr. **69**:1372, 1922.

8. Baudouin: Une expérience relative à la vision binoculaire, Gaz. méd., Paris **4**:247, 1904.

9. Hillemanns, M.: Die funktionelle Asymmetrie der Augen; die Vorherrschaft eines derselben und die binokulare Richtungslokalization, Klin. Monatsbl. f. Augenh. **79**:737, 1927.

10. Esser, A. M.: Aeugigkeit und Händigkeit, Klin. Monatsbl. f. Augenh. **78**:332, 1927.

11. Stern, H. J.: Ueber Vorherrschaft eines Auges (Aeugigkeit) und ihre Beziehung zur Händigkeit, Arch. f. d. ges. Physiol. **233**:793, 1934.

12. Ludwig: Rechts- und Links-Problem, in Gildemeister, M., and others: Monographien aus dem Gesamtgebiet der Physiologie der Pflanzen und der Tiere, Berlin, Julius Springer, 1932, vol. 27.

relationship is not as constant. Many of them are right-handed through training. With regard to ocular dominance Parson stated that once this is acquired it is never changed by education or training. Only when the dominant eye has suffered an injury or visual depreciation can a transfer be effected.

Engeland, to avoid the use of the hands in his tests, adopted the following procedure: A small mark is placed on a mirror. The patient is asked to fix his eyes on the tip of his nose in the mirror and at the same time endeavor to cover the spot on the mirror with the tip of his nose. By alternately closing one eye he observes that the spot on the mirror does not move when he closes the nondominant eye.

Parson, who has written an excellent book on this subject, came to the following conclusions in regard to ocular dominance and left-handedness. The earliest ancestors of present-day man possessed pure binocular vision; i. e., they used either eye with equal freedom. The next stage was the development of fixed unilateral sighting, because they learned that for sighting one eye could perform this function better than both eyes. The dominance of the right eye, therefore, developed as a result of natural selection due to some now obscure causes. "We are brought," Parson stated, "to the conclusion that eyedness, accompanied by handedness is a fixed characteristic of the race, pure binocular vision accompanied by ambidexterity representing the ancient parent type."

He invented an instrument for testing ocular dominance, which he called the manuscope. It is held by the hands of the person tested and embodies the principles of Miles and his paper cone test. On testing 877 pupils with this instrument, Parson found more than 69 per cent were right-eyed and right-handed. As to the relationship between the eye and the hand, he held that ocular dominance is the cause of the handedness. Moreover, he asserted that this ocular dominance cannot be transferred to the other eye by training or education. He also affirmed this as regards handedness. Twitmeyer agreed with him on this point. Parson also expressed the belief that the left cerebral hemisphere has a functional superiority over the right.

The determination of the eye which deviates the least may also be used as a test for ocular dominance. Mills studied this deviation of the dominant and the nondominant eye by having the subject fix the eyes on an object as it was moved toward them. In the majority of cases the nondominant eye deviated outward while the dominant eye remained convergent.

Krämer,[18] after studying the relation between squint and ocular dominance, expressed the belief that just as the speech center is at first

13. Krämer: Ueber den Einfluss der Rechts- und Linkshändigkeit auf die Entwicklung des führenden Auges und des Strabismus concomitans unilateralis, Ztschr. f. Augenh. **57**:322, 1925.

bilateral and later wanders to the left cerebral hemisphere, one may suppose that a similar change takes place in regard to vision. The left hemisphere gradually gains functional predominance and causes the right side of the body, especially the eye and hand, to assume the dominant rôle. At the same time vision in the opposite eye gradually falls, and the squint appears. His studies showed that the majority of patients who have squint in the right eye are left-handed. He also stated that if a person during early life has equally good eyes, but if for some reason squint develops in one eye, if he is right-handed, the squint will always be in the left eye, whereas if he is left-handed the squint will be in the right eye.

Esser reported an interesting case of a 3 year old girl with convergent squint in the right eye of one year's duration. The patient had also been left-handed for the previous year. Vision was weaker in the right eye. The mother had noticed a year before that the child was left-handed and that all her attempts to train the child to use the right hand were unsuccessful.

The left eye (the better eye) was then occluded, and the child was urged to use the right eye. Three months later she was again seen. The mother stated that the child was then using the right hand. As soon as the pad was removed from the left eye the child again went back to the use of the left hand. This case shows that there is some relationship between eyedness and handedness. Esser explained the transfer in this case by assuming that one always uses the hand which is on the same side as the better-seeing eye.

Hillemanns concluded from his studies on the convergence power and muscular balance in close work that one eye predominates for all close work and that this is usually the right eye. In studying the deviation of each eye under cover during convergence he found that the nondominant eye deviated outward more than the dominant eye. For this reason he assumed that the eye having the greater convergence power is the master eye. In close work the nondominant eye serves little purpose. In fact, Best and Bielschowsky have shown that in microscopic work there is actually a central scotoma in the nondominant eye. In myopic patients, since the right eye is used more, it also has the greater error. Hillemanns expressed the opinion that this dominance is not congenital. It is developed and strengthened from early youth and cannot be changed to the other eye. He also stated that the line of sight is not in the median plane of the body but tends to deviate to the side of the dominant eye. (Hering, Helmholtz and Bielschowsky also made this statement.)

Hillemanns used different-colored glasses before each eye and found that the color was more vivid and appeared more quickly in the dominant eye. In some persons this test is a failure, as they cannot

fuse or obtain a mixture of colors in this fashion. In fact, Helmholtz admitted that personally he could not obtain any mixture in such tests, although he believed that others could.

Lineback,[14] using his own modification of Rosenbach's test, examined 600 persons and found that more than 90 per cent were right-eyed. He also examined anatomically 18 pairs of human eyes in an attempt to discover whether there was any structural condition in the right eye to account for this ocular dominance. In every pair of eyes examined the fovea was found closer to the optic disk in the right eye than in the left. The nearness of the fovea of the right eye may explain the dominance of this eye on the assumption that the fovea of the right eye reaches the line of vision more quickly than that of the left.

Miles has developed an excellent test to show ocular dominance in children. The person tested is asked to view a card held by the examiner through a paper cone held in both hands. The person tested is then asked to name the letters he sees. The examiner, standing in front of the person, can see at a glance which eye is the dominant eye.

Bethe, in discussing his own findings, expressed the belief that there is no evidence of any cerebral dominance in the sense that the left cerebral hemisphere is superior to the right. Ocular dominance, in his opinion, cannot be considered the result of unilateral cerebral superiority, since each macula has a bicortical representation. The dominance, if any, is functional and acquired.

Stern obtained different results in his cases, depending on the different type of test used. He therefore devised his own instrument, which he called the latoscope. His results showed that there is ocular dominance in binocular vision. He offered an interesting explanation to account for the variation in the percentages obtained. Some tests determine the ocular dominance in the sense of an organ preference, while others show an ocular dominance in the sense of a visual field preference. Both types of reaction may be obtained in the same person. However, this idea is not original with Stern, for many years ago Ducasse and Stevens[15] wrote:

> By reason of the fact of a marked difference in space sense of the two halves of the retina, those objects in the right half of the field of vision by appearing larger, attract the visual attention which in turn leads to grasping movements of the right hand.

Ludwig recently described a scientific study of this entire subject in human beings and animals. In his opinion, the unequal function in binocular vision is not understood. He has often found students who

14. Lineback, P.: Some Observations on the Mechanism of Double Vision, Anat. Rec. **38**:193, 1928.

15. Ducasse and Stevens: The Retina and Righthandedness, Psychol. Rev. **19**:1, 1912.

could not use the binocular microscope because of the confusion caused by the image of the nondominant eye. He believes that eyedness and handedness are related and inherited and that left-handedness and left-eyedness are recessive characteristics and follow the mendelian laws. The work of Litinskij [16] supports this assumption. If one is to accept the work of van Biervliet,[17] who found that the visual acuity of the right eye excels that of the left eye by as much as one-ninth, one can logically assume that dominance of the right eye is the expression of a unilateral functional asymmetry of the left cerebral hemisphere.

Not all writers on this subject accept these conclusions. Woo and Pearson [18] attacked some of them. They have given special attention to the work of Parson. They questioned many of Parson's statements and conclusions and on the basis of their own experiments stated that they did not believe in any ocular dominance. It is true that some of Parson's arguments are open to criticism. Induction and a priori arguments are vulnerable points in any scientific article. It may also be true that a false explanation is worse than none; nevertheless, any theory offered to explain the reason for ocular dominance must contain a certain number of evolutionary and inductive arguments.

The numerous theories advanced to explain why there is ocular dominance and why the dominant eye is the right and not the left are interesting but are not of concern at this time. They are all reviewed in the work of Ludwig.

Ludwig concluded from his studies that there is no difference in size, shape, weight or fine histologic structure between one hemisphere and the other. To explain the occasional differences that are seen between eyedness and handedness he listed four types of inversion: (1) forced inversion (*Zwang-Inversion*), due to some loss in power or function of the eye or hand through accident or disease; (2) pathologic inversion, due to a lesion of the brain; (3) phenotype inversion (there is no proof that this type takes place in man; one knows, however, that by high temperature of the water or by changes in its salt content Ascaris and the sea urchin may be made to exhibit certain changes, and one may assume that this form of inversion may also occur in man); (4) inversion due to education or training. He summarized the whole subject by stating that ocular dominance, handedness and unilateral localization of the speech center—in other words, sidedness (*Seitigkeit*)—are the expression of a functional asymmetry of the left hemisphere.

---

16. Litinskij: Ueber die Bedeutung der führenden Hand, des führenden Auges, Heterophorie und Refraktion in der Aetiologie des Strabismus, abstr., Zentralbl. f. d. ges. Ophth. **21**:809, 1929.

17. van Biervliet: L'homme droit et l'homme gauche, Rev. phil. **47**:133, 276 and 371, 1899.

18. Woo, T. L., and Pearson, K.: Dextrality and Sinistrality of Hand and Eye, Biometrika **19**:165, 1927.

One may ask oneself of what importance this subject is to the ophthalmologist. Has it any practical application? According to Sheard,[19] it has, and a very important one. Few authors of articles on testing the muscular balance have even mentioned it. In nearly all the textbooks binocular vision is represented and discussed on the basis of triangulation. The line joining the nodal points of the eyes is considered the base of this triangle, and the object fixed by both eyes in the median plane is considered equidistant from the two nodal points. However, in the majority of cases no such ideal or mathematical picture occurs. In fact, in all right-eyed persons this triangle is a right-angled triangle, with the right angle at the nodal point of the right eye. Each eye has a definite function to perform. The dominant eye sights and fixes objects; the nondominant eye attempts to estimate distance and the position of objects in space.

In testing the muscular balance, over which eye should the Maddox rod be placed? Maddox stated: "If alternate fixation makes the streak shift to divergent figures on the tangent scale, the case is one of either anisometropia or paresis." Sheard did not accept this explanation. He expressed the belief that the Maddox rod should always be placed over the nondominant eye and never over the dominant eye. Moreover, if for some reason vision is better in the nondominant eye than in the dominant eye, the patient will have greater comfort if vision in the nondominant eye is undercorrected. When prisms are prescribed, they should always be placed before the nondominant eye, if possible.

If one is to accept the statements of the writers on this subject that more than 80 per cent of all persons are right-eyed, and if one admits that the right eye is the sighting eye, the obvious conclusions of Sheard should not be ignored.

CONCLUSIONS

1. The majority of human beings possess a dominant eye.
2. This eye is the right eye in more than 80 per cent of cases.
3. There is a direct relationship between the eye and the hand.
4. Practically all right-eyed persons are right-handed. Left-eyed persons, owing to training, may be either right-handed or left-handed.
5. In testing with the Maddox rod for muscular imbalance, the rod should always be placed over the nondominant eye (the left eye in most cases).
6. When prisms are prescribed, they should always be placed before the nondominant eye, if possible.

19. Sheard: The Dominant or Sighting Eye, Am. J. Phys. Optics **7**:558, 1926.

Obituaries

HENRY B. YOUNG
1851–1934

Dec. 10, 1934, marked the passing of Dr. Henry Byrd Young of Burlington, Iowa. His death at the age of 83 closed an active practice in ophthalmology extending over fifty-five years.

His father, Dr. John Young, settled in Monmouth, Ill., to practice in 1839, and he was educated at Monmouth College and at the Chicago Medical College, later Northwestern University Medical School, receiving his degree in 1875. After a year of general practice, he was persuaded by Dr. Henry Gradle to go abroad for further studies and spent a year in the clinics of Heidelberg, Vienna and Edinburgh. Most of this time was spent with Billroth, Braun von Fernwald and Neumann. He found time, however, for courses in ophthalmoscopy under Kirschbaumer and in otology under Gruber. In Edinburgh he saw the early aseptic surgery of Lister and witnessed the presentation of a memorial urging him not to leave that city for London.

Returning to Monmouth, he soon acquired an interest in ophthalmology, and in 1879 he opened an office for special practice in Burlington, where he found his life's work. He was a keen observer, combining excellent clinical judgment with a good surgical hand, and his practice grew rapidly. From 1881 to 1885 he was lecturer in ophthalmology at the Keokuk Medical College, an experience which he described as profitable for his own education at least.

In 1898 he was elected president of the Iowa State Medical Society, and soon after he was made ophthalmologist to the Burlington Railroad. This gave him facilities for frequent trips to Chicago, where he became an active member of the Chicago Ophthalmological Society. He never missed one of its annual meetings till his death. He was always on the alert to familiarize himself with advances in ophthalmology, spending several months with Dr. Herman Knapp in New York and making frequent visits to other medical centers. He was a member of the American Academy of Ophthalmology and Otolaryngology and contributed to its programs papers on "Amblyopia from Auto-Intoxication," "The Sociological Aspect of Deafness" and "Observations on the Negative Phase of Contagion in Trachoma." His graduation thesis in 1875, nine years before Koller's use of cocaine, entitled, "Analgesia as a Substitute for Anesthesia in Minor Surgical Operations," was reprinted in 1933 by the Iowa Medical Society because of its historical interest.

He maintained friendly relations with many prominent ophthalmologists, and his cheerful presence and keen personal observations were always welcome at meetings. The year before his death he was asked to prepare an autobiography, which was published as a monograph by Northwestern University. It contains many interesting stories of early practice and is full of the author's good humor and homely philosophy. It shows a happy life made rich with useful activity and a mind which use never allowed to tarnish.

SANFORD R. GIFFORD.

News and Notes

SOCIETY NEWS

Ophthalmological Society of the United Kingdom.—In conjunction with the annual congress of the society, to be held in London on April 4, 5 and 6, 1935, the following meetings will take place:

Wednesday, April 3

9:30 a. m., International Council of Ophthalmology
12 noon, International Trachoma Organization, delegates' meeting
2:30 p. m., International Trachoma Organization, scientific meeting

Thursday, April 4

9:30 a. m., International Trachoma Organization, executive meeting

Friday, April 5

10 a. m., International Association for Prevention of Blindness, meeting of executive committee
2 p. m., International Association for Prevention of Blindness, general meeting

The public meetings are open to members participating in the congress.

The main subject for discussion at the congress will be "Diseases of the Blood and Their Ophthalmological Complications." Sir Arnold Lawson, Dr. H. L. Tidy, Prof. E. C. Dodds and Dr. P. N. Panton will open the discussion, and any members wishing to take part should notify Mr. R. C. Davenport before February 28.

International Congress of the History of Medicine.—The Tenth International Congress of the History of Medicine will take place in Madrid, Spain, from Sept. 23 to 29, 1935. The following subjects will be discussed: "Arabian Medicine in Spain," "The Medicine in America During Its Discovery and Colonization" and "Medical Folklore in the Different Civilized Countries."

Those desiring to participate are asked to send abstracts of their communications before June 1, 1935 to the scientific secretary of the congress. All summaries received in due time will be published. The following languages are considered official: English, French, German, Italian, and Spanish.

GENERAL NEWS

The Seeing Eye, Morristown, N. J.—In December 1934, under the direction of Elliott S. Humphrey, vice-president of the Division of Training, The Seeing Eye inaugurated a course of training for instructors who will train dogs and teach the blind how to use them. Eight apprentices, selected from approximately one hundred applicants, are the first men to receive such training in America.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Anatomy and Embryology

THE FIBRILLAR SUBSTANCE OF THE VITREOUS. M. BAURMANN, Arch. f. Ophth. 132: 302 (June) 1934.

Baurmann is well known for his previous work on the ultramicroscopic colloidal structure of the vitreous. In this paper he reports some experiments which were undertaken to prove or disprove some of the findings of Goedbloed (Over de struktur en den tonus van het corpus vitreum, Leiden, 1932).

Goedbloed contended that the vitreous is not capable of swelling (turgescence) or of taking up water again after it has lost some. Baurmann replies by giving the results of experiments in which the vitreous bodies taken from ox eyes were bisected and immersed in solutions of alcohol and sugar of varying concentrations. The volume of the vitreous first dropped considerably (initial osmosis) and then slowly increased again. The vitreous, therefore, does take up water again after it has lost some (reversible loss).

Baurmann believes that the fibrillar substance makes up the vitreous gel. Therefore he repeated the experiments on turgescence with the isolated fibrillar substance. The latter can be separated from the remainder of the vitreous by filtration and washing with distilled water. The pores of the filter must be just wide enough to let proteins through. The fibrillar substance remains on the filter because of the length of the fibrillae.

The fibrillar substance was exposed to solutions of hydrochloric acid and potassium hydroxide with a range of p_H from 0.5 to 12. The maximum of turgescence was found to lie at a p_H between 6.4 and 8; the minimum, which probably represents the iso-electric point, lay at a p_H of 2.4 (in previous experiments of Baurmann and Duke-Elder at 4.5). From these experiments it is certain that the fibrillar substance is capable of forming a gel with potassium hydroxide and hydrochloric acid and also of swelling.

Drying of the fibrillar substance over phosphorus pentoxide reduced the ability of the fibrillar substance to swell somewhat, while drying at 110 C. completely deprived it of that faculty.

Baurmann discusses his findings in connection with Loeb's theory concerning the mechanism of turgescence of proteins. According to this theory, the amount of turgescence is determined by the excess of ions in the colloid electrolyte over the amount of ions present in the milieu fluid. This excess of ions in the colloid electrolyte varies with varying p_H, always maintaining a Donnan equilibrium with the milieu fluid. Baurmann finds that the volume of the fibrillar substance parallels the degree of ionization of the colloid electrolyte. Thus the turgescence of the vitreous seems to follow Loeb's idea concerning the swelling of proteins in general.

The capacity of the vitreous to swell is unusually great. This fact makes Baurmann speculate about a special arrangement of the micelles in the vitreous gel. He suggests that a stretching of the ultramicroscopic fibrillae accompanies the process of turgescence. The fibrillae most likely consist of several longitudinal rows of molecules which are "chained together."

Concerning the question whether the granules which can be seen under the ultramicroscope in the acidified vitreous represent parts of the original fibrillae (Baurmann) or coagulated mucoprotein (Goedbloed), Baurmann seems to be ready for a compromise. He insists, however, on his observation that the original fibrillae are transformed into shorter "granular chains." "Whether the granules remain arranged in chains or whether the chains fall apart into shorter pieces or into single granules, I cannot decide."

P. C. KRONFELD.

STUDIES OF THE VITREOUS: PART I. F. GOEDBLOED, Arch. f. Ophth. 132: 323 (June) 1934.

Goedbloed deals with the ultramicroscopic appearance of fresh vitreous of cattle in its natural condition and also under the influence of hydrating and dehydrating salt solutions. He confirms the observations of Baurmann and Heesch that fresh vitreous (three hours after the death of the animal) shows under the ultramicroscope a fibrillar structure. This ultramicroscopic structure has, he states, some relation to the slit-lamp appearance of the vitreous. Areas with loose arrangement of the fibrillae may alternate with areas where the fibrillae are more tightly packed. The slit lamp reveals interwoven lighter and darker bands in the vitreous which may express those regional changes in the density of the fibrillar arrangement. Hydrating and dehydrating salt solutions have typical effects on the fibrillae. The former make them more and more indistinct up to a state of complete colloidal dissolution. The latter make the fibrillae very distinct and pronounced. The state of hydration and the visibility of the fibrillae seem to go parallel.

Similar, though less intensive, variations of the hydration of the vitreous are produced by changes in the hydrogen ion concentration. The state of hydration increases toward the alkaline and decreases toward the acid side. Baurmann has described a "falling apart" of the fibrillae when the vitreous is brought into a very acid milieu. Instead of the fibrillae, fine granules appear. This observation is not confirmed by Goedbloed. He believes that the fine granules are derived from a protein substance of the vitreous which is coagulated by the high acidity. The fibrillae have not fallen apart and can be rendered visible by adding a strong salt solution to the acidified vitreous.

The fibrillae, according to Goedbloed, do not represent the smallest particles of the vitreous gel. He elaborates a very plausible hypothesis according to which the fibrillae are the result of linear aggregation or juxtaposition of micelles.

In the course of chemical studies of the vitreous, Duke-Elder found the so-called residual protein. Goedbloed believes that the fibrillae are made up of that residual protein.

P. C. KRONFELD.

Bacteriology and Serology

THE PATHOGENICITY OF STREPTOCOCCI AND PNEUMOCOCCI FOR THE HUMAN EYE. H. SCHMELZER and E. ECKSTEIN, Arch. f. Ophth. **132:** 24 (March) 1934.

Seventy-one cases of serpiginous ulcer have been treated at the eye clinic of the University of Erlangen (Germany) during the last two and a quarter years. Sixty-six per cent of them were caused by pneumococci, 17 per cent by diplobacilli and 17 per cent by Streptococcus viridans. The corneal ulcers due to streptococci took, on the whole, a milder course. They respond well to iodine but not to ethylhydrocupreine. The so-called pneumococcic conjunctivitis was rare. From 76 cases of acute conjunctivitis, in most of which petechiae in the bulbar conjunctiva, chemosis and mild blennorrhea were present, Str. viridans was grown, while in only 14 clinically similar cases pneumococci were found to be the cause.

Despite all usual precautions 5 suppurative infections occurred among 275 cataract extractions. In those cases germs (diplobacilli in 1, gram-positive diplococci in 2 and Staphylococcus aureus in 2) were grown from the conjunctiva. They disappeared after a combined treatment with mercuric oxycyanate irrigations, ethylhydrocupreine or drops of a flavine dye and a bland antiseptic ointment before the operation.

In smears it was often impossible to differentiate between pneumococci and streptococci, so that cultures were nearly always necessary. The authors recommend the "silk thread" method: Two short pieces of fine sterile silk are kept in the conjunctival culdesac of the patient for two minutes and then put in bouillon and on a blood agar plate. Sometimes, however, the culture method revealed only saprophytes, while pathogenic germs were seen in the smear. P. C. KRONFELD.

Conjunctiva

THE LOCAL APPLICATION OF ANTIGONOCOCCIC SERUM IN GONOBLENORRHEA AND OTHER EYE DISEASES. W. A. WILLE, Brit. J. Ophth. **18:** 218 (April) 1934.

From the knowledge that several of the therapeutic serums have a decided effect when injected parenterally Wille was led to try the effect of antigonococcic serum applied to the conjunctiva in gonococcic conjunctivitis. First the conjunctiva was cautiously cleansed with solution of boric acid and afterward dried. As much of the serum was instilled as was necessary to cover the whole surface of the everted conjunctiva. The eyelids were kept everted for about fifteen seconds. This treatment was repeated four times, with five minute intervals. Strong silver protein, 2 per cent, was also used hourly.

Wille states that this mode of treatment was used in all cases of gonococcic conjunctivitis during the past five or six years, "with especially good results." Two illustrations are cited.

The serum has been found of value in the treatment of trachoma and vernal conjunctivitis. W. ZENTMAYER.

Congenital Anomalies

CONGENITAL BILATERAL ECTOPIA OF THE LENS AND ARACHNODACTYLIA. KILLMANN, Klin. Monatsbl. f. Augenh. **92:** 335 (March) 1934.

Congenital bilateral ectopia of the lens was found in 40 per cent of persons with arachnodactylia. Killmann reports on eight cases of this type. One of them was atypical; it occurred in the 30 month old son of one of the patients. Two of the patients were females and six were males. All were tall, their skulls dolichocephalic, their features elongated, the chin long in one of them, and their hands and feet large. Curvature of the spine existed in four of them. Contraction of the flexors of the fingers and toes, congenital disorder of the heart and flatfoot were further anomalies; muscles and subcutaneous fat were underdeveloped.

Congenital bilateral ectopia of the lens was noted in the seven typical cases of arachnodactylia, concomitant strabismus in four and atrophy of the stroma and of the pigment layer of the iris in one. Changes in the fundus were present in three of these patients; glaucoma, in none.

Metabolic tests made on three patients did not reveal disease of the hypophysis; roentgenograms showed normal size and structure of the sella turcica and normal long bones, except in one boy. This boy, aged 6, had incomplete epiphyseal lines in the distal end of one metacarpus and the head of one metatarsus.

Dominant heredity was demonstrated positively in two and evidently in one patient by objective examination, and it was suspected from the history in two others. Syphilis, consanguinity and alcoholism could be excluded.

K. L. STOLL.

Experimental Pathology

INFLUENCE OF OCULAR INJURIES ON OCULAR LOCALIZATION OF TUBERCLE BACILLI SUSPENDED IN THE BLOOD, AND REMARKS ON SYMPATHETIC OPHTHALMIA. LOPES DE ANDRADE, Klin. Monatsbl. f. Augenh. **92:** 350 (March) 1934.

At A. von Szily's University Eye Clinic in Münster, Germany, the author studied the influence of a previous ocular lesion on the local occurrence and course of intra-ocular tuberculosis after a hematogenous infection. In thirty-eight rabbits, under general anesthesia, from six to eight fine radial perforations were made with a scarificator in the area of the ciliary body of the right eye. Immediately afterward or from several to twenty-four hours later a culture of tubercle bacilli (Schroeder-Mietzsch-Baumgarten) was injected intravenously. The left eye remained intact. Tuberculous symptoms developed somewhat more frequently in the injured eye: in fifteen rabbits with positive tuberculous changes the injured eye was involved fourteen times and the uninjured eye nine times. The tuberculous process was decidedly more serious in the injured eye. The predominance of an involvement of the anterior segment, especially of the ciliary body, of the injured eye showed that previous injury favors the localization of intra-ocular tuberculosis. This is of importance in deciding the question of a connection between injury and tuberculous disease. Disease of the injured eye is in no way con-

ditional for involvement of the uninjured eye; the injured eye may remain free, while the uninjured eye may show grave tuberculous symptoms. Clinical and histologic observations proved the presence of tuberculosis.

No evidence was found for the tuberculous origin of sympathetic ophthalmia in man.

K. L. STOLL.

General

THE EYE DROPPER. T. J. DIMITRY, J. A. M. A. **102:** 2180 (June 30) 1934.

Dimitry has devised a dropper to obviate the danger that can come from disintegrated rubber in an open wound. The tubing is made of glass of any length, the smaller end and the rubber bulb remaining the same. At the bulb end the lumen of the tube is reduced to capillary size. The outer dimensions remain in conformity with the rest of the tube. To make the dropper even more certain in action so as to avoid the vacuum lost, a second form has been constructed in which one or more capillary tubings are inserted into a glass tubing and made enduring by the application of heat. These smaller tubings prevent the fluid from coming in contact with the rubber bulb. A modification of Stearn's container for eye medication is also suggested.

W. ZENTMAYER.

A PROTECTIVE MASK FOR USE AFTER OPERATION ON THE EYE. H. KIRKPATRICK, Brit. J. Ophth. **18:** 271 (May) 1934.

The mask is made by molding dental stent onto the plaster cast of a face, the eyes of which are represented by large globular prominences. Care is taken to mold the wax accurately onto the orbital margins, and an aperture is made in the center of each eye projection.

Holes for ventilation and the attachment of tape are pierced with any suitable instrument while the mask is being made.

The prominence over the palpebral aperture permits the use of standard dressings, but bandages are unnecessary.

W. ZENTMAYER.

General Diseases

OXYCEPHALY IN BROTHERS. M. R. SAWHNEY, Brit. J. Ophth. **18:** 169 (March) 1934.

The ages of the boys were 5 and 11 years. The symptoms were the same in both: fairly typical oxycephaly with high palatal arches and fairly well marked bilateral exophthalmos and ptosis. The lids could not be raised voluntarily. The eyeballs were fixed in the middle line and there was complete inability to move the eyes in any direction. The immobility was not due to the exophthalmos. The fundi, vision and fields were practically normal. There were two other boys and two girls in the family. They and the parents were normal. The article is illustrated.

W. ZENTMAYER.

Glaucoma

SONDERMANN'S THEORY AND CLINICAL VIEWS OF GLAUCOMA. S. SONDERMANN, Klin. Monatsbl. f. Augenh. **92**: 313 (March) 1934.

Valuable views and suggestions are given by Sondermann regarding the theory and therapy of glaucoma. The intra-ocular tension is the result of the blood pressure in the capillaries of the uvea, the osmotic blood pressure, the production of aqueous humor and its drainage. Increased congestive pressure in the vortex veins caused by sclerosis of the sclera produces an increased formation and drainage of aqueous humor in senile eyes. The secondary decrease of the tension after injection of suprarenin and of hydrocyanic acid into the vitreous is produced by increased, but not by decreased, production and filtration of aqueous humor. Injections of saline solution may act in the same manner. The fluorescein test should be used more exhaustively than hitherto for the control of results in experiments on the circulation in the eye; it may be very valuable in the diagnosis of preglaucomatous conditions and malign glaucomas. Used before the operation and after recovery, this test may help in obtaining information regarding the mechanism of the result of the operation. Sondermann analyzes the action of the miotics, of suprarenalin and of divers operations in connection with his theory of glaucoma. These considerations are followed by the discussion of a new operative method by which opening of the anterior chamber is avoided. It should be the aim in such an operation to produce drainage for the relief of the vortex veins and to form a direct vascular connection between the ciliary body and the episclera. The importance of general treatment is emphasized, and new prophylactic possibilities are pointed out.

K. L. STOLL.

TREPHINING AFTER ELLIOT IN CONGENITAL HYDROPHTHALMOS FOLLOWED BY PROLAPSE OF THE RETINA INTO THE ANTERIOR CHAMBER: REPORT OF A CASE. O. KARASEK, Klin. Monatsbl. f. Augenh. **92**: 389 (March) 1934.

A girl, aged 7, had bilateral congenital hydrophthalmos. The corneal diameters were 11 mm. vertical by 11.5 mm. horizontal in the right eye, and 13.5 mm. vertical by 14 mm. horizontal in the left. Scleral trephining after Elliot, done by A. Elschnig, was uneventful in the right eye, but was followed by total detachment of the retina in the left. On the second day after the operation, when the cornea had cleared, further changes could be noticed. The lateral pillar of the coloboma was pushed toward the cornea by a fold of the retina. The lens, examined with the slit lamp later on, was subluxated nasalward and downward; it was perfectly clear, so that the detached retina could be observed behind it. The prolapsed portion of the retina had retracted spontaneously two months later, but the retina remained detached; no tear was found. The vision was reduced to uncertain perception of light; the tension remained low.

The cause of the prolapse and detachment of the retina was the sudden escape of the aqueous humor and the liquefied vitreous and, probably, partial luxation of the lens prior to the operation; distinct

iridodonesis had been noted on admission to the hospital. The detachment of the retina occurred immediately after the escape of the intraocular fluid, in Karasek's opinion, but not as a consequence of a detachment of choroid and retina.

K. L. STOLL.

Hygiene, Sociology, Education and History

WOOLHOUSE (1666-1733-1734). R. R. JAMES, Brit. J. Ophth. **18:** 193 (April) 1934.

An excellent notice of Woolhouse and his works is to be found in the "Dictionary of National Biography," but James has in this sketch tapped some sources which would appear not to have been used before: viz., the will of Woolhouse, the larger collection of his letters preserved in the Sloane manuscript at the British Museum and in the "Letter-Books of the Royal Society," and the manuscript volume of notes on his lectures which is the property of the Royal Society of Medicine.

When one considers the state of ophthalmology in his day, he cannot in justice be called a quack. He was apparently not an ambulant practitioner, though accounts state that he toured the Continent at the outset of his career. If this is allowed, the fact remains that he was resident in Paris for a great many years. He rode his hobby of scarification too hard, and in later life he touted his English colleagues in the Royal Society for patients, but two hundred years ago this was not considered such an unethical business as it would be today. In some of his views he was ahead of his time, but he was frankly an obstructionist in the matter of the seat of cataract. His writings are said to border on those of a charlatan, but his will is an absolutely honest document. The preparation of this paper entailed considerable research.

W. ZENTMAYER.

Injuries

PENETRATING WOUNDS OF THE ORBIT. H. T. COLLEY, Brit. J. Ophth. **18:** 241 (May) 1934.

The subject of penetrating wounds of the orbit is reviewed and commented on, and three cases are recorded. The first case was one of penetration of a piece of wood into the orbit. The symptoms were those of orbital infection with involvement of the cavernous sinus. The splinter was 18 mm. in length and 9 mm. wide at its base. The wound and tract had to be enlarged to effect its removal. Recovery was uninterrupted.

In the second case the child was stooping to pick flowers when he felt a prick above the eye. A few days later an abscess of the orbit developed, suggestive of frontal sinus infection. A piece of stick about 32 mm. long was discovered in the wound. Some restriction of the movements of the globe resulted.

The third case was that of an injury to the orbit from a fall into a thorny hedge. There were proptosis, resistance on backward pressure of the globe, and almost complete external and internal ophthalmoplegia. Vision equaled 6/60. The visual field was contracted above.

The fundus was normal. Within two months the movements and function of the eye were restored almost completely. The optic papilla was paler than normal.

A careful history should be taken in all cases of wounds in the region of the orbit. The depth of the wound should be investigated. A roentgenogram should be made, but too much reliance should not be placed on a negative report. Small metallic foreign bodies, especially if they have entered when heated, are often better left alone. Large foreign bodies, especially wood, should be removed as quickly as possible.

W. ZENTMAYER.

INJURY TO BOTH THE ORBITS WITH A REVOLVER SHOT CAUSING LITTLE DAMAGE. J. N. DUGGAN, Brit. J. Ophth. **18:** 253 (May) 1934.

Duggan saw the patient, a man aged 48 years, four months after the injury. The shot went in a straight line through both the orbits, entering at the right temple and emerging at the left temple. Vision of the right eye equaled 6/36, and that of the left eye 6/9.

The right eye was proptosed and displaced upward. The right inferior rectus was inactive. The right pupil was semidilated and reacted sluggishly. The right optic papilla was pallid. The retina contained a few pigmented spots near the ora serrata in the inferior temporal quadrant. The fundus of the left eye showed a big tear in the choroid concentric with the margin of the papilla at the temporal side.

W. ZENTMAYER.

Lens

SENILE CATARACT: A STUDY OF THE BIOLOGY AND CHEMISTRY OF THE CRYSTALLINE LENS. D. B. KIRBY and R. v. E. WIENER, Brit. J. Ophth. **18:** 388 (July) 1934.

This paper deals with a joint consideration of the biology and the chemistry of the crystalline lens both in the normal and the abnormal state and with a hypothesis of the development of cataract. Growth and structural changes in the normally aging lens and the chemistry and nutrition of the normal lens are considered. Other considerations are: analogous changes observed in other cells and organs, especially cells of bradytrophic tissues; changes in permeability in aging cells; the rôle of calcium and lipoids in the changes in permeability, and hereditary factors influencing the aging of an organ or part of an organ. The conclusions are: The theory which regards senile cataract merely as an expression of early senility in the eye suffers from generality. Yet if one compares the chemistry and the structural changes of the normally aging lens with those of certain types of cataract one is impressed with the similarity of many changes which qualitatively are alike and differ only quantitatively. Various factors, such as starvation, insufficient supply of oxygen, nervous influences, toxins or enzymes, may initiate the changes which prepare cells for their dissolution. It is difficult to limit the etiology of senile cataract to a single factor or group of factors. Changes in permeability of the capsule and of the

lens fiber membranes, changes in diffusion in the fibers and in the interfibrillar spaces, changes in the water-binding properties of the lens protein, early loss of vital parts of the cells, abnormal infiltration with fat and with inorganic material may all play an important part in initiating a cataract.

The protoplasm of the lens fibers may bear the imprint of its genes in the structures of component molecules, atoms and micelles. The structural configuration of the proteins of the fibers derived from mother cells with pathologically altered genes may be such as to offer little, if any, resistance to proteolytic intracellular enzymes or the infiltration of lipoids. If, in addition, there is a local autochthonic factor for promoting the deposition of lipoids the stage is set for the beginning of the cataractous changes. If the constitution of the fibers of the lens is such as to confer on it susceptibility to these changes which are able to produce opacity because of a weakening of the cellular or protoplasmic resistance, cataract may be viewed as germ-plasmatically determined.

Such a condition may be brought about either by hereditary weakness in the genes or by changes in the environment which in turn weaken the genes. In this way one may explain the earlier occurrence of cataract in patients with hormonal and nutritional deficiency diseases or with diabetes mellitus. According to this hypothesis concerning the formation of senile cataract, the primary change is a genetically induced change in the structural configuration of the protein molecule. The genealogy of families in which senile cataract prevails may be difficult to work out, owing to variations produced by environment, but the hypothesis merits consideration.

W. ZENTMAYER.

CATARACT AND THYROID-PARATHYROID DISORDERS. P. SAINTON, J. de Rollat and F. KAYSER, Bull. Soc. d'opht. de Paris, March 1934, p. 133.

Twelve cases of cataract and thyroid-parathyroid disorders were observed in six cases; the calcium content of the blood was between 95 and 106 mg. per thousand cubic centimeters of serum, which must be considered normal. From an endocrinologic standpoint the patients' disorders were diagnosed as follows: (1) hyperthyroidism with Chvostek's sign; (2) hereditary cataract with signs of polyglandular disturbance; (3) hypoparathyroidism and hypopituitarism; (4) hypothyroidism with cataract formation in three generations; (5) hypothyroidism; (6) hypothyroidism and hypoparathyroidism. In four cases an increase of calcium of between 114 and 133 mg. was noted. Two of the patients had the syndrome of hypothyroidism with hyporchidism; the other two had myxedema and signs of mild hypothyroidism, respectively. In two cases the calcium reached a level of from 153 to 164 mg; both patients had hypothyroidism. The authors conclude that the figures for calcium may not be considered as a guide to the treatment of cataracts in patients with disorders of the thyroid or parathyroid glands. Certain cataracts remain stationary under parathyroid extract therapy. Whether this is accidental or due to the therapy is difficult to decide. The findings are comparable to those in sclerodermia, rheumatism and certain tetanies and merit further study.

L. L. MAYER.

PRECISE DETERMINATION OF THE IMPORT OF VITAMIN C IN THE NORMAL AND THE CATARACTOUS LENS. J. NORDMANN and H. VAN WIEN, Bull. Soc. d'opht. de Paris, March 1934, p. 136.

A discussion of the methods of determining the content of vitamin C in the lens has led the authors to present one which does away with many of the faults found in other methods. The method is outlined in detail. The results obtained are as follows: beef lens, 0.25 mg. of vitamin C per gram of fresh lens substance; rabbit lens, 0.016 to 0.026 mg.; human lens, from 0.011 to 0.016 mg. In experimental cataracts produced in rabbits with naphthalene the finding was 0.0053 mg. Human intracapsular cataracts contained 0.0026 mg. The authors conclude that opacification of the human lens is accompanied by reduction in the cysteine, glutathione and vitamin C, but they believe the process is secondary and relatively late.

L. L. MAYER.

A TRAUMATIC CATARACT UNDER THE POSTERIOR CAPSULE WITH ROSETTE: SPONTANEOUS SUBTOTAL RESORPTION. MASSELIN, Bull. Soc. d'opht. de Paris, March 1934, p. 169.

Masselin reports a case in which a knitting needle penetrated an eye as far as the anterior vitreous. The needle was extracted with a simple forceps. The tension was normal and vision 4/50. The opacity of the lens cleared in twenty-five days with no evidence of inflammatory reaction. Visual acuity increased to 4/10. The rosette formation was characteristically described by Vogt.

L. L. MAYER.

FURTHER INVESTIGATIONS OF THE TOXICITY OF THE LENS. REINHARD BRAUN, Arch. f. Augenh. **108:** 341, 1934.

The blood pressure of rabbits and cats was recorded from the common carotid artery under ether or a barbituric acid derivative anesthesia, and the changes due to injections of extracts of lens material were measured. Braun concludes that aqueous and alcoholic extracts of fresh and dried lenses cause a reduction of the blood pressure. This fall in blood pressure is not due either to histamine or to acetylcholine. Some unknown factor in the lens substance must be responsible. The inflammatory reactions of some eyes after operation for cataract are probably due to the toxic effect of lens material remaining in the anterior chamber.

F. H. ADLER.

THE CLINICAL AND HISTOLOGIC PICTURE OF CATARACT OF ENDOCRINE GLAND ORIGIN. A. LÖWENSTEIN, Arch. f. Ophth. **132:** 224 (April) 1934.

Certain types of "endocrine cataract" are generally recognized as such, while others give rise to a question of their cause. The cataract which develops during the course of tetany, neurodermatitis, juvenile diabetes or myxedema belongs in the first group. The cataract in myotonia and the lens opacities which occur in scleroderma fall into the second group. Löwenstein is of the opinion that cataract caused by endocrine gland disturbance is much more common than is generally assumed. He also believes that such cataracts in young persons present

a characteristic picture, namely, subcapsular shield-shaped opacities with arcade-shaped outlines. In the paper under review he tries to explain the shape and arrangement of the opacities by toxic effects of endocrine products on circumscribed areas of the capsular epithelium. Anatomic changes in the epithelium are described in three cases, in two of which there were no gross clinical signs of endocrine gland disturbance. The third case was that of a child with neurodermatitis who died from severe and prolonged gastro-enteritis.

The evidence in favor of Siegrist's view of the endocrine gland origin of senile cataract is very meager. No additional evidence can be obtained *ex iuvantibus*. It is certain now that—with the one exception of diabetic cataract—even in cataract obviously due to endocrine gland disturbance the treatment with the specific hormone fails. According to Löwenstein, senile cataract is caused by a physical change in the structure of the colloid of the lens capsule, brought on simply by old age. Thus the permeability of the capsule is changed and the interior of the lens exposed to the substances dissolved in the aqueous.

P. C. KRONFELD.

Lids

A NEW OCULOPALPEBRAL SYNDROME. G. BOREL, Ann. d'ocul. **171**: 207 (March) 1934.

A child of 3 years, well nourished and intelligent, was brought for consultation because of swelling of the upper lids with consequent ptosis. There was a small amount of pus in the eyes. The child had been operated on many times without success. The eyes looked normal except for conjunctival redness, and there was some photophobia. On the upper lid of each eye was an odd fatty tumor of cartilaginous consistency, measuring a few millimeters, the surface being irregular, with large symmetrical pedicles.

The condition is a nosographic entity of a chronic infectious nature and of grave prognosis, being generally fatal. It is accompanied by high fever and membranous complications in the nose and throat. It is not transmissible by inoculation to animals and is refractory to cultures as well as to treatment, attacks children from 2 to 10 years of age, very exceptionally occurs in both eyes and produces flat hard tumors as described.

S. H. MCKEE.

Methods of Examination

THE USE OF ARTIFICIAL SUNLIGHT FOR ILLUMINATING TEST APPARATUS AND GENERAL LIGHTING FOR EXAMINATION ROOMS. R. E. WRIGHT, Brit. J. Ophth. **18**: 260 (May) 1934.

The so-called daylight lamps put on the market in recent years give light that has little resemblance to daylight. The artificial production of the softer yellow, more pleasant tint of direct sunlight has been attended by better results.

Wright has found that a special gas-filled, 240 volt, 500 watt Mazda bulb mounted in a reflector with a cooling device gives efficient illumination for test cards. Ideal for screen work are two such lamps placed on the ground or on small tables behind the patient. Apart from the

efficiency of the illumination and the ease with which it can be adapted to ordinary desk work, general or special examination of the patient or special examination in any part of a large or a small room, the comfort of the light for reading, its warmth and the general psychic effect on the patient and the doctor are not to be lost sight of.

The article is illustrated.

W. ZENTMAYER.

AN OPHTHALMIC RULE. N. B. HARMAN, Brit J. Ophth. **18:** 273 (May) 1934.

Harman presents a new pattern for an ophthalmic rule which he devised in 1910. It is for the purpose of measuring the base line. It is made of duralumin stamping. It weighs half an ounce (14 Gm.). The rule is black with the millimeter scale engraved on it and filled in with white. There is a range of from 45 to 80 mm.

The patient looks at a light in the distance and the observer sights with his own left eye the wire of the rule against the spot of light on the patient's right eye, and with his right eye the other wire on the spot of light on the patient's left eye.

The article is illustrated.

W. ZENTMAYER.

OBSERVATION OF THE VASCULAR TREE OF PURKINJE BY THE SCLERAL LAMP. G. PACALIN, Bull. Soc. d'opht. de Paris, March 1934, p. 152.

The communication of Villard and Viallefont concerning the use of the slit lamp to demonstrate entoptic phenomena has prompted Pacalin to report his method. By simple pressure on the lids with the end of the scleral lamp a beautiful picture of the retinal vascular tree will be seen by the operator. The advantages of this method over that of the slit lamp are that the lids remain closed, and the field of vision is not limited by the palpebral opening and is much larger.

L. L. MAYER.

Neurology

OPTICOFACIAL WINKING REFLEX. S. M. WEINGROW, Laryngoscope **44:** 515 (July) 1934.

In eliciting the opticofacial reflex (closure of the lids when an object is brought suddenly into the field of vision) for testing unilateral or bilateral impairment or destruction of vision, Weingrow places his hand above, to the side of or below the eyes of the subject and out of his field of vision; then he moves it suddenly across the field of vision, thus causing a sudden closure of both lids. If one eye is shielded by a piece of cardboard and the other eye stimulated, there results a bilateral closure of the lids. The afferent path of this reflex is the same as that of the emergency light reflex, but the efferent path seems to be confined to the facial nerve. Weingrow reports cases in which visual impairment was presented, with consequent involvement of the opticofacial reflex, and refers to reports of cases in which the efferent part of the opticofacial reflex arc was involved.

[J. A. M. A.]

A Case Report: Agranulocytic Anemia Following Herpes Ophthalmicus. I. Mann and D. Baker, Brit. J. Ophth. **18:** 458 (Aug.) 1934.

In a woman, 38 years of age, who was recovering from right ophthalmic herpes involving the eyeball, there were a slight ciliary flush, precipitates on the posterior surface of the cornea and a slate-colored scleral scar. About seven months later a permanent opacity developed in the cornea. The optic nerve was never affected, and vision was 6/5.

During the three years preceding the patient's death, she had severe pyorrhea, tonsillitis and an axillary abscess. Several drugs of the barbiturate group had been used from time to time. The blood picture was that of agranulocytic angina. Death resulted from pneumonia. The authors realize that the ophthalmologic interest in the case is small, and that probably little connection exists between the antecedent ocular condition and the subsequent history.

W. Zentmayer.

Contractions of the Iris in Mental Disease. A. Barbé, Presse méd. **42:** 876 (May 30) 1934.

With the premise uppermost in mind that "the eye is one part of the brain which is visible," Barbé compares the pupillary reaction of the normal person with the reactions found in mental patients. The ophthalmometer of Javal and Schiotz was used in this study. The difficulties of examining patients of this type are stressed.

The main points noted are the time during which the iris remained immobile after the initial stimulation and the number of oscillations during the first and the second minute following the first contraction. These oscillations were found to be of two types, one feeble and difficult to note, the other clear and repeated at regular intervals.

The following eleven conditions were investigated: state of arrested intellectual development, senile dementia, discordant psychosis, convulsive state, hallucinatory state, melancholia, obsession, dementia paralytica, the interpretative psychosis, maniacal excitation and exhaustive psychosis.

In arrested intellectual development there was a marked retardation of the onset of the oscillations, which were noted as being very feeble.

The majority of patients with senile dementia showed no oscillations.

Discordant psychosis is also classified as dementia praecox, the condition usually beginning at the time of puberty. In all of these the initial reaction was greatly retarded. After the initial contraction only from three to seven oscillations occurred in the next two minutes.

In the convulsive states oscillations were, at times, retarded five or six minutes. They were usually normal in excursion and frequency.

In hallucinatory states oscillations were retarded greatly, but their frequency and amplitude were characteristically variable.

It was noted in melancholic patients that when anxiety was marked the oscillations were infrequent and feeble, but that in patients showing improvement normal reactions were recorded.

In obsession the oscillations showed two characteristics. They were sluggish in appearance and less frequent (six to seven in a minute).

Most of the patients with dementia paralytica had Argyll Robertson pupils, but a few showed late, feeble oscillations.

When the condition was an interpretative psychosis the oscillations were retarded, rare and feeble.

The patients suffering from maniacal excitement were difficult to observe. In this state the pupils were widely dilated and no oscillations occurred.

The progress of the exhaustive psychoses was indicated by the return of the iris reactions to normal.

Barbé submits the study for the consideration of others in evaluating progress in psychiatric diseases.

L. L. MAYER.

OCULOPHARYNGEAL REFLEX. A. P. DI SORRENTINO, Riforma med. **50:** 891 (June) 1934.

Di Sorrentino studied the oculopharyngeal reflex in a number of patients at the moment of instillation of a medical solution into the conjunctival sac. The reflex consists in a movement of rapid deglutition together with a spontaneous closing of the eyes. The swallowing is not associated with the contraction of the orbicular muscle of the eyelid. The reflex was found in only a small number of patients, most of whom were children from several months to 13 years of age. The presence or absence of an ocular disease had no influence on the sign. The chemical composition of the substances instilled into the conjunctival sac likewise had no influence on it. The reflex may be produced by touching the bulbar conjunctiva with a common glass spatula. The temperature of the stimulating factor, whether the latter is a liquid or a spatula, is important. A low temperature yields greater stimulation than an average or a relatively high temperature. The sections of the stimulated conjunctiva (nasal or temporal) do not disclose anything of significance except that the bulbar part is more sensitive than the palpebral. The few adults demonstrating the reflex showed signs of an extremely parasympatheticosthenic condition and marked hypothyroidism. The phenomenon is interpreted as a reflex of a predominantly vagotonic constitution. Most of the subjects show a constant hypotonia of the endocrine sympathetic system with a prevalence of the parasympathetic section. Di Sorrentino states in conclusion that the nervous path followed by the centripetal stimulus is the trigeminal, while the centrifugal path taken by the motor impulse is represented by the nerves of deglutition.

[J. A. M. A.]

THE CHANGES OF THE VISUAL CORTEX IN ECLAMPSIA. G. BODECHTEL, Arch. f. Ophth. **132:** 35 (March) 1934.

Bodechtel has studied the changes of the brain which occur in uremia. He has found that there is no basic difference between the changes occurring in the spastic uremia of Volhard (in acute nephritis) and those occurring in eclampsia. In the latter the cortex is only more extensively and more severely damaged. The damage is not visible to the naked eye. The microscope reveals changes in the cells of the fourth and fifth layer of the area striata which are of the type described by Spielmayer as "ischemic cell disease." The nuclei of the affected cells are dark; their nucleoli swell up or become dissolved. The Nissl

granules in the cell body disappear, so that the protoplasm looks homogeneous. The cell borders become very indistinct. These changes are the earliest pathologic manifestations of eclampsia. If the severe clinical symptoms of eclampsia persist for over twelve hours before death occurs, softenings involving nerve cells and glia are observed.

The area striata is often spared by the eclamptic process, apparently because of an unusually good blood supply. The aforementioned brain changes are not caused by edema of the brain, but by ischemia.

P. C. KRONFELD.

THE SYNDROME OF THE NASOCILIARY NERVE: REPORT OF TWO CASES. J. VERDAGUER and H. VON DESSAUER, Klin. Monatsbl. f. Augenh. **92:** 513 (April) 1934.

The authors describe the anatomy of the nasociliary nerve, and report several cases of a hitherto unrecorded oculonasal syndrome resembling in some instances the syndrome of the sphenopalatine ganglion reported by Charlin. The following triad of symptoms is typical for the nasociliary syndrome:

1. Inflammation of the anterior segment of the globe. This may occur in the shape of ulcerous keratitis with erosions or ulcers, cyclitis, several forms of iritis, or conjunctivitis with a pseudopurulent abacterial secretion.

2. Neuritis with tenderness on touch in the course of the infratrochlear nerve and the external nasal branch, or with hyperesthetic or anesthetic zones in the skin, or with vesicles in the area of the cutaneous ramifications of the nasociliary nerve. Vascular or secretory disturbances in the skin have been observed. The neuralgic pain is most acute in the eye, the orbit and the forehead.

3. One-sided rhinitis with abundant nasal discharge and severe swelling of the mucous lining in the anterior third of the nostril of the same side.

This syndrome should be considered in every case of pathologic changes of the anterior segment of the globe coupled with rhinitis. Recovery in cases of local origin is brought about within a few days by insufflating into the nose a powder containing cocaine and epinephrine. Ethmoidal sinusitis, if present, must be treated. Inefficiency of this therapy points to a general disease, such as diabetes or syphilis, which demand proper care.

K. L. STOLL.

RELATION BETWEEN PATHOLOGIC ANATOMIC CHANGES AND CLINICAL SYMPTOMS IN A CASE OF METASTATIC CARCINOMA IN THE STEM OF THE OCULOMOTOR AND OPTIC NERVES. F. POOS, Klin. Monatsbl. f. Augenh. **92:** 585 (May) 1934.

Poos adds a case of direct metastasis in the optic nerve to the eight cases recorded in ophthalmologic literature. A woman, aged 39, had noticed increasing deterioration of vision in her right eye accompanied by headache since the summer of 1932. In February 1933 vision was reduced to the counting of fingers at close range. The lower nasal portion of the field of vision presented a large defect in the absence

of any ophthalmoscopic changes. A large central scotoma and pallor of the temporal portion of the disk developed within a few weeks and amaurosis with rigor of the pupil soon afterward. The first cerebral symptoms, insufficient for localization of the focus, and paralysis of the oculomotor nerve, incomplete at first, were noted in May 1933. The left eye, normal up to that time, simultaneously showed rigidity of the pupil, which was larger than the right, supposedly owing to beginning paralysis of the left oculomotor nerve. Vision and the field of vision in the left eye remained normal up to two weeks prior to death. Pathologic examination revealed a small primary carcinoma in the pancreas, with metastases in the liver, spleen, lungs and portal and mediastinal lymph nodes. Metastases were found, furthermore, in the right optic nerve, the chiasm, both oculomotor nerves, the dura of the posterior part of the cranium and some vertebrae. The anatomic findings explained the clinical ocular symptoms, but the latter were too vague to allow one to make a diagnosis, especially since the carcinoma of the pancreas with its metastases could not be recognized clinically.

K. L. Stoll.

Ocular Paralysis in the Symptom Complex of Status Dysraphicus; also a Contribution to the Etiology of Sympathetic Paralysis (Horner's Syndrome and Heterochromia Iridis) as well as Trigeminal, Abducens and Facial Nerve Paralysis. A. Passow, München. med. Wchnschr. **81:** 1243 (Aug. 10) 1934.

In seeking the etiologic factor in many of the hereditary neurologic diseases there is often reason to believe that embryologic changes may account for the subsequent pathologic conditions. One outstanding example of this is the demonstration by Henneberg that the spongioblastomas in syringomyelitis are united at the spinal raphe.

Bremer, in a systematic search for some of these signs in patients and their relatives in whom syringomyelia developed, called attention to certain anomalies which would seem to be embryologic defects in the form of a heredodegenerative dysraphia. Certain of these are of a vasomotor or trophic nature, causing dissociated anesthesias or changes in the color and temperature of the fingers. Anomalies of the chest, such as funnel chest, spinal derangements like kyphoscoliosis and abnormalities of the breast, such as mammary differences, belong in this group. In addition to the aforementioned signs, Passow would include others of interest primarily to the ophthalmologist. These include Horner's syndrome and heterochromia, especially when no definite etiologic factor is evident. In a systematic examination of seventy patients with either or both of the aforementioned signs, certain observations were made: Funnel chest was often present. An enlarged span of the arms over that of the patient's body and that of other, normal persons was often seen. Brighter pigmentation of the mamma on the same side as the heterochromia was observed. Horner's syndrome, funnel chest and webbed fingers occurred frequently in the same patient

In other patients, with paralysis of either the trigeminal, abducens or facial nerves, in which the etiologic factor was not clear, many of the stigmas of status dysraphicus were noted. Passow believes that

in many cases heterochromia and Horner's syndrome associated with paralysis of nerves and other symptoms of status dysraphicus, when not otherwise explainable, may be due to a syringomyelja. Interesting photographs accompany the article.

L. L. MAYER.

Ocular Muscles

THE DIVERGENCE OF THE PRIMARY POSITION OF THE EYES. N. A. STUTTERHEIM, Brit. J. Ophth. **18:** 256 (May) 1934.

As previously set forth, Stutterheim considers the anatomic position of the eyes (slight divergence) as the primary position of the "bi-unial" eye, and terms it "primary divergence." The degree is measured by finding the strength of prisms, placed base in, with which single vision can be maintained. The displacement from the primary position of bifoveal vision, e. g., in reading, can be found by adding the angle of primary divergence to the angle of convergence. The force required for overcoming the elastic pull of the primary position can now be calculated for every bifoveal visual movement. The primary divergence by its elastic pull during bifoveal single vision causes a uniform tenseness as a basis for the delicate accuracy of human binocular movement.

A difference in the average amount of primary divergence is established between Bantu and European.

The primary divergence enlarges the range of comfortable binocular movement, e. g., in reading.

W. ZENTMAYER.

A CLASSIFICATION OF CASES OF CONCOMITANT STRABISMUS BASED ON THE ETIOLOGIC FACTORS. M. A. PUGH, Brit. J. Ophth. **18:** 433 (Aug.) 1934.

An analysis of 500 cases of squint gave the following results: refractive error squint, 62 per cent; fusion defect squint, 15 per cent; psychologic squint, 20 per cent, and physical defect, 2 per cent.

The refractive error squints are those which fit in with Donders' theory: The hyperopic ones converge and the myopic ones diverge. The best correcting lens is that which gives the best vision, with fusion at zero in distant vision. Training does much to stabilize the convergence during accommodation, but in refractive error squints correct spectacles are essential.

Fusion defect squints correspond to Worth's group. In this group the accommodation-convergence link is of very secondary value and spectacles cannot be adjusted to be of use in lessening the deviation as in the refractive error squints.

Psychologic squints fulfil Inman's expectation of a patient with squint. The patients are often emmetropic. An analysis of 103 cases gives the following results: (*a*) Imitative squint, 7 per cent. (*b*) Jealousy squint, 10 per cent. A frequent cause is the advent of a new baby. The wish seems to be to bring the focus of attention back to the patient. (*c*) Fear of shock squint, 26 per cent. The squint often develops as a direct result of trauma. (*d*) Difficult children, 28 per cent. Ten of these were left-handed, while the others showed the self-willed characteristics that psychologists associate with left-handedness.

Four of these patients also stammered. (*e*) Psychoneurotic parents, 29 per cent. In these cases the home conditions allowed no liberty or peace in which the child might acquire a balanced psychologic background.

(*f*) Physical defect squints. In this group fall those squints in which the involved eye is irrevocably amblyopic, either congenitally or as a result of injury or disease. It is difficult to assess the relative significance of the factors concerned in the etiology of squint as there is so much overlapping and two factors may have an equal value. The foregoing classification has been found useful and of practical value, especially in prognosis.

W. ZENTMAYER.

THE SIGNIFICANCE IN STRABISMUS OF SYMPTOMS OF DEGENERACY AND UNILATERAL PREDOMINANCE OF THE BODY. O. LIPPMANN, Klin. Monatsbl. f. Augenh. **92:** 370 (March) 1934.

Lippmann discusses the theories of the etiology of strabismus and the question of the relation between the predominant hand and the predominant eye. He then reports his research on the relation between the prevalent use of one eye, one hand or one half of the body with the strabismic aberration of one eye. He found that strabismus is not a symptom of degeneracy. Stammering occurs as often with strabismus as without. Left-handedness does not favor the development of strabismus. The predominant side of the body influences the strabismic side, especially in patients who have isometropic and equal eyes. The left eye is generally more often strabismic than the right eye. Left-handedness in a person with an existing disposition to strabismus causes aberration of the right eye. The presence of a predominant eye does not cause disposition to the development of strabismus, if the eyes are otherwise equal.

K. L. STOLL.

Operations

OBSERVATIONS ON SOME MATTERS ASSOCIATED WITH EXPERIMENTAL CORNEAL GRAFTING. J. W. T. THOMAS, Brit. J. Ophth. **18:** 129 (March) 1934.

Thomas has shown (*Tr. Ophth. Soc. U. Kingdom* **51:** 88 and 96, 1931) by experimental work on the eyes of rabbits that corneal tissue of whole thickness can be transplanted from rabbit to rabbit successfully and that the grafts can remain transparent when a particular technic is followed. In the present communication further records of homogeneous grafts are given, and the results of homogeneous and heterogeneous grafts are compared. The method of preventing adhesion of the iris to a corneal graft is discussed, and some observations are made on the sensitiveness of corneal grafts, and on the clinical examination of an eye with an opaque cornea. Of sixteen homogeneous grafts, ten were transparent, one had a clear area, one was nebulous with clear areas, three were opaque and one became detached. This represents 62 per cent clear grafts and 75 per cent that would allow clear vision. Of five heterogeneous grafts, one from a human eye and four from cats' eyes, all five united, but none was clear. There is a tendency for heterogene-

ous grafts to vascularize, whereas homogeneous grafts remain clear and avascular.

Obviously any one desirous of performing the operation of corneal grafting will consult the several papers of Thomas for details.

The article is illustrated.

W. ZENTMAYER.

Physiology

THE SODIUM CHLORIDE CONTENT OF TEARS IN NORMAL AND DISEASED EYES. D. MICHAIL and P. VANCEA, Compt. rend. Soc. de biol. **115:** 894, 1934.

The reported data on the sodium chloride content of tears show wide variations. In the latest results published (Roth, 1922), the average content found was 0.948 per cent.

With the use of blunt capillary pipets gently placed laterally in the lower culdesac, 0.1 cc. of tears can be collected in from three to ten minutes. In fifteen normal eyes the sodium chloride content, determined by the Volhard-Rousnjak technic, averaged 0.823 per cent. In acute ocular disease the salt content diminished on an average of 0.07 per cent, but in chronic cases the tears tended to become more salty, the average increase being 0.065 per cent.

J. E. LEBENSOHN.

Refraction and Accommodation

FOGGING FOR THE FOCAL INTERVAL OF STURM. N. CLEGG, Brit. J. Ophth. **18:** 264 (May) 1934.

Clegg's charts include the linear test type chart, which enables the axis and the amount of astigmatism to be judged by the relative intensity of blackness of the main axis, and an anchor chart, which has the additional refinement of its barbs for the 30, 60, 120 and 150 axes. With this information the exact axis and amount of astigmatism can be ascertained by the dial chart. The spotline test type chart for testing visual acuity has the most obvious letter (6/60) used as an indicator by being placed between the 6/9 and 6/6 lines, which are thus as easily referred to as the 6/18 line at the top of the chart.

The secret of success with all such charts is adequate fogging, which simulates the use of mydriatics [cycloplegics] by relaxing the accommodation.

The article is illustrated.

W. ZENTMAYER.

INFLUENCE OF ASTIGMATISM OF THE ANTERIOR SURFACE OF THE CORNEA ON TOTAL ASTIGMATISM OF THE EYE. L. N. GASSOWSKY and V. G. SAMSONOWA, Arch. f. Ophth. **132:** 297 (June) 1934.

The manifest total refraction of 300 eyes was determined with the refractionometer of Rodenstock. The corneal radii of curvature were measured in the same eyes with the ophthalmometers of Javal and Sutcliff. The data thus obtained brought out the well known fact that there is no simple or constant relation between corneal and total astigmatism.

P. C. KRONFELD.

DOES THE HUMAN EYE POSSESS THE ANATOMIC BASES FOR HELMHOLTZ' THEORY OF ACCOMMODATION? A. VON PFLUGK, Klin. Monatsbl. f. Augenh. **92:** 445 (April) 1934.

Von Pflugk devised several apparatus for the study of the accommodation of the human eye. He found that Helmholtz, and also Gullstrand, based their theories on two unknown entities, namely, the elasticity of the lens and its anterior capsule and the extensibility of the zonula. The disproving of these premises, the result of the research of Heine and Hess, and Pflugk's own experiments prompt him to the following conclusions: 1. Hess is right in refuting the statement of Helmholtz that "the pressure of the surrounding tissues preserves the tension of the lens while the eye is focused for distance." 2. The lens, removed from its surroundings and measured at its anterior pole, never shows a radius of more than 8 mm. against 5 to 6 mm. during accommodation. Thus the more accommodation increases the more the lens becomes removed from its state of rest. 3. The zonula cannot extend the lens; it ruptures rather than extends the capsule of the lens noticeably. The change of the form of the lens, in Pflugk's opinion, can be explained only by some force acting on the lens from without. This force can only be the pressure of the vitreous body on the posterior surface of the lens, while the zonula must necessarily be tense, but not relaxed.

K. L. STOLL.

Retina and Optic Nerve

BILATERAL PAPILLITIS FOLLOWING ANTIRABIC INOCULATION: RECOVERY. H. S. CORMACK and L. A. ANDERSON, Brit. J. Ophth. **18:** 167 (March) 1934.

A healthy normal woman was bitten on the arm by a dog which was certified rabid March 3, 1932. She was given 5 cc. of a 5 per cent phenolized sheep vaccine for fourteen days, receiving in all 3.5 Gm. of killed sheep mixed virus. No untoward symptoms were observed during the treatment, which terminated March 18, 1932.

Nine days later the sight of the right eye, and three days later the sight of the left eye, began to grow dim. Vision of the right eye equaled 6/36, and the left eye was blind. Both eyes showed a papillitis. At the end of two weeks the sight gradually returned, and at the end of two months vision and fields were normal, except for a small centrocecal absolute scotoma. One year later the fundus and vision were normal, but the scotoma persisted.

The authors state that there seems to be no reason to suppose that the optic nerve should necessarily be exempt from attack by a disease the incidence of which in the nervous system is so widespread.

W. ZENTMAYER.

A CASE OF VON HIPPEL'S DISEASE. E. V. SRINIVASAN, Brit. J. Ophth. **18:** 221 (April) 1934.

A man, aged 26 years, had angiomatosis in the right eye. The vessels emanating from the papilla at 2 o'clock had two aneurysmal dilatations, one near the papilla and the second well out in the periphery of the fundus, in the midst of a tangle of vessels. The macula presented a

granular red circle with a diameter one-half that of the papilla. There was a tendency to corkscrew tortuosities of the finer and medium-sized vessels.

Srinivasan believes the macular condition to have been the sequel of Berlin's disease, which was caused by a blow received on the eye from a tennis ball seven years previously.

There was no sign of intracranial involvement. The Wassermann reaction was negative.

W. ZENTMAYER.

FOLDING OF THE RETINA FROM AN EXUBERANT FRONTAL MUCOCELE. D. MICHAIL, Ann. d'ocul. **171**: 126 (April) 1934.

Folding of the retina from orbital causes has been reported very seldom, and knowledge of it has not as yet become of practical value. Little clinical knowledge has been obtained of the appearance of the lesion or of its pathologic mechanism. For this reason it was thought wise to report in detail a case in which folding of the retina was caused by a mucocele of the frontal sinus.

The patient, 56 years of age, had complained at intervals for six years of pain in the left frontal sinus accompanied by corresponding progressive exophthalmos, which with other ocular troubles obliged her to consult an ophthalmologist. The clinical study, the roentgenogram and the operation showed the existence of an exuberant mucocele of the left frontal sinus, which after having completely destroyed the floor of the sinus progressed into the orbit. The orbital invasion caused an exophthalmos of 8 mm. and vertical compression of the ocular globe, shown by hyperopic astigmatism of 1.5 diopters and by about twenty horizontal parallel retinal folds situated on the temporal side of the disk. This was accompanied by peripapillary edema and perivascular retinitis.

The article has four illustrations, that of the retinal folds demonstrating the clinical condition very well.

S. H. MCKEE.

TRANSUDATIVE PIGMENTARY CHORIORETINITIS. METTEY and REDSLOB, Ann. d'ocul. **171**: 396 (May) 1934.

In 1924 a robust woman, married, whose parents were alive and well and who had one child of 4 years and a negative family history, complained of failing vision in the left eye. This had been noticed over a period of six months. The refraction was normal in each eye. The visual acuity, equal to 1 in the right eye, was only 0.03 in the left eye and was not improved by glasses. Examination of the nose and sinuses revealed no pathologic condition. The Wassermann reaction was negative. In short, physical examination and laboratory tests revealed no cause for the condition.

Examination of the left fundus showed in the macular region a raised yellowish-gray lesion. The disk gradually became swollen, but there was no great change over a period of two years during which the patient was under observation. She was then lost sight of until 1930, when it was found that vision in the left eye was reduced to perception of light. As the swelling of the macula suggested an intra-ocular growth, the eye was enucleated. The results of the pathologic exam-

ination are given in detail. The eye disclosed degeneration of the retinal elements and marked thickening and dilatation of the choroidal vessels.

S. H. McKee.

Gumma of the Papilla. Opin, Arch. d'opht. **51**: 193 (April) 1934.

Gumma of the papilla is exceptionally rare. Opin believes that the term "papulous neuritis" proposed by A. Fuchs is especially appropriate. He gives a detailed account of a case which he has observed over a period of several years. Leber in 1914 cited seven cases. Since then several other reports have been made. In 1926 Fuchs published four cases and presented a precise description of the condition based on his own and four other examples. In 1931 Puscariu reported a case. Opin reviews Fuchs' report in some detail. All the cases have essentially similar characteristics. The vitreous may or may not contain opacities. The disk is seen to be covered completely by a mass of exudate either grayish white or yellowish gray This mass may be voluminous, giving the impression of a tumor projecting into the vitreous. Its borders are frequently cleancut. In addition there may be retinal hemorrhages of various kinds, the vessels showing little change. Sometimes there are isolated patches of choroiditis. Vision is always greatly reduced. Various types of changes may be found in the fields. In all the cases only one eye has been involved. Frequently there is an iritis in both eyes, more intense in the eye without the ophthalmoscopic lesion. The progress of the disease is slow. It occurs most often between the ages of 23 and 32. In all cases except two syphilis has been proved. Fuchs suggests that the process is similar to the formation of nodules in the iris. In a few cases, besides the exudate on the disk, a star figure has been observed in the macula not unlike that which occurs in renal retinitis. The author's case presented such a figure. His case was also one of those in which syphilis was not proved except for the response to antisyphilitic treatment.

S. B. Marlow.

The Treatment of Circinate Retinitis. E. Redslob, Bull. Soc. d'opht. de Paris, March 1934, p. 119.

Previous reports of the treatment of this condition have been discouraging. From a report of the pathologic aspects made by Morax (*Ann. d'ocul.* **163**: 801, 1926) the localized angiosclerosis seems to be the outstanding change. Redslob reports a case of two years' duration in which subcutaneous injections of acetylcholine were used. The results indicate to him that the angiosclerosis is a result of angiospasm over a long period of time. Vision was held stationary and the progress of the disease was stopped with the acetylcholine. He has used the drug in only one case of this type.

L. L. Mayer.

Notable Modification of the Ophthalmoscopic Picture in a Severe Case of Diabetic Chorioretinitis Following Diathermic Puncture of a Tear. L. Pavía, Bull. Soc. d'opht. de Paris, March 1934, p. 140.

In the case of a diabetic patient, aged 58, with 350 mg. of blood sugar, a fatal prognosis had been made. In the one remaining eye

vision was reduced to bare perception of light in the upper and lateral portions of the retina and was entirely lost above. Most of the details of the fundus were masked, but a tear in the retina was localized with much difficulty. Exudates had disorganized most of the retina. Diathermic punctures were made in the region of the tear. One month following the operation visual acuity was 1/16; the fields were increased, that of the superior portion of the retina to 30 degrees. Many of the large exudates had disappeared. Pavía offers this form of treatment as one possibility in an attempt to improve the very desperate condition in cases of this type. Stereoscopic pictures of the fundi and pictures of the diathermic points accompany the article.

L. L. MAYER.

THE RETINITIS DUE TO ARTERIAL HYPERTENSION. A. MAGITOT, Bull. Soc. d'opht. de Paris, March 1934, p. 156.

A brief history of the study of hypertension in its relation to the retina is outlined. The first period begins with work of von Graefe, who attributed the ocular lesions to uremia. The second period was ushered in by the work of Widal on the kidney. The third and last period saw the revelations of Rochon-Duvigneaud that hypertension may exist without involvement of the kidneys. Magitot divides the retinal hypertension of Bright's disease into two types. The one is acute and progressive. The patient complains of visual loss, headache and muscae volitantes. In the second type the visual difficulties are noted late, and the retinal lesions are usually discovered accidentally. The outstanding signs, namely, white exudates, edema of the disk, hemorrhages and modifications of the vessels, are discussed. The use of Bailliart's instrument is emphasized as being of much value. The index of Fritz (lessened compressibility of the retinal arteries) and augmentation of the pressure of the cerebrospinal fluid are added signs of Bright's disease.

In a second category Magitot places hypertension without impairment of renal function. In diagnosis, this form must be differentiated from the retinitis of diabetes. The pathologic nature of the white plaques and vascular lesions is discussed in detail. The theoretical causes of malignant hypertension are discussed on an anatomic basis under the headings of "toxic causes" and "vascular causes." Case reports are given to illustrate the various types.

L. L. MAYER.

THE CHANGES IN THE RETINAL ARTERIAL PRESSURE AFTER CAROTID DECORTICATION IN MAN. A. MAGITOT and P. DESVIGNES, Compt. rend. Soc. de biol. **116:** 302, 1934.

The effect of arterial sympathectomy on the retinal circulation in man was studied by the following procedure: After decortication and phenolization of a portion of the common carotid and internal carotid artery and resection of the carotid ganglion, the changes in blood pressure in the central retinal artery were followed by Bailliart's ophthalmodynamometer method. After an interval of from ten to twenty-five days the same operation was performed on the opposite side.

With unilateral arterial sympathectomy, an immediate, but transient, bilateral hypotension ensues primarily, followed in two to three days by a secondary bilateral hypertension for from one to five days, after which the blood pressure in the central retinal artery oscillates, with a final stabilization at its previous level.

Bilateral arterial sympathectomy produces hypotension lasting twenty-four hours, followed by a hypertensive phase in which, despite succeeding oscillations, the blood pressure remains steadily higher than it was prior to the operation.

Augmentation of the retinal blood pressure tends to improve visual acuity in diseases of the optic nerve and retina, while a lowered blood pressure has the opposite effect.

J. E. LEBENSOHN.

Comparison of Results Obtained in Treatment of Retinal Detachment by the Methods of Gonin and Guist

	Gonin			Guist		
Duration of Detachment	Patients	Number Cured at Time of Discharge from Hospital	Number Cured at Time of Reexamination	Patients	Number Cured at Time of Discharge from Hospital	Number Cured at Time of Reexamination
Eyes with tears						
Up to 2 months	39	13	15	34	16	19
2 months to 1 year	21	7	6	15	10	9
Over 1 year	5	2	4	5	4	4
Eyes without tears						
Up to 2 months	10	2	2	5	3	3
2 months to 1 year	3	1	1	2	1	1
Over 1 year	1	1	0	5	3	4
Aphakic eyes with tears						
Up to 2 months	1	0	0	6	3	3
2 months to 1 year	0	0	0	2	0	0
Over 1 year	0	0	0	5	0	0
Aphakic eyes without tears						
Up to 2 months	4	2	2	1	0	0
2 months to 1 year	0	0	0	1	1	1
Over 1 year	2	0	0	0	0	0

END-RESULTS OF SURGICAL TREATMENT OF RETINAL DETACHMENT: REPORT OF THE SECOND EYE CLINIC IN VIENNA. L. KLEINER, Arch. f. Ophth. **132:** 265 (June) 1934.

Kleiner reexamined the cases of retinal detachment in which operations were successful at the Second Eye Clinic of the University of Vienna during the years from 1928 to 1931. Eighty-three cases fell into this group. In seventy-three of them the patients either reported at the clinic for reexamination or replied to a questionnaire so that the outcome could be determined. In sixteen of the seventy-three cases the detachment had recurred, in twelve within the first six months and in four within one year after the last operation was performed for the original detachment. In four of the cases of recurrent detachment the patients refused further operation, and in one case of recurrence the operation

failed, so that altogether five of the seventy-three eyes which were cured of the first detachment succumbed to a recurrence.

As found first by Sallmann and Sveinsson, central vision and the visual fields improved slowly after the retina became reattached. Of the cured eyes, 70.3 per cent reached the best vision within the first year; the remaining 29.6 per cent, within the second year following the last operation. The recovery of the peripheral portion of the retina was comparatively slower inasmuch as only one half the retinas regained normal borders during the first, and the other half during the second, year following the reattachment. In no case did the vision seem to be impaired through or because of the operation. Only a moderate contraction of the fields in three cases could be considered as an injurious effect of the operation.

Thorough examination of the eyes which remained cured revealed no damage to the lens. In that connection Kleiner makes the statement: "No eye in which before or during the course of the surgical treatment at our clinic signs of complicated cataract developed was cured of retinal detachment."

Finally a comparison was made between the results obtained with the original method of Gonin and those obtained with the method of Guist:

The table shows clearly that Guist's method of multiple trephining with cauterization by means of potassium hydroxide leads to a greater number of successes in a consecutive series of retinal detachments than the ignipuncture of Gonin does. P. C. KRONFELD.

HEMORRHAGE OF THE FUNDUS. P. WEINSTEIN, Deutsche med. Wchnschr. **60**: 604 (April 20) 1934.

A study of hemorrhages into the fundus of the eyeball in relation to the general vascular system is the object of this paper. By means of the Plesch *Tonoszillograph* (*Tonoszillographen*) a definite idea of the status of the peripheral vascular wall is obtained. The instrument and its method of recording are described in detail. Graphs show the curves of tonus of normal and of thick-walled, sclerotic arteries and atonic vessels, and the curves after inhalation of amyl nitrite. Not only the internal tension of the artery is registered but also its elasticity. In the treatment of conditions such as embolism of the central artery or thrombosis of the central vein, the effect of amyl nitrite or of acetylcholine, as used by the French, may be clearly registered. Photographs of the curves show the marked change caused by amyl nitrite at varying times after its injection. These curves are quite different in the normal, the hypertonic and the hypotonic vessel. L. L. MAYER.

A CONTRAINDICATION IN OPERATIONS FOR DETACHED RETINA: REPORT OF A CASE. E. SEIDEL, Klin. Monatsbl. f. Augenh. **92**: 397 (March) 1934.

A man, aged 60, apparently perfectly healthy, was operated on successfully with diathermy for detached retina with myopia of 7 diopters. He died from embolism of the heart five days later. Seidel points out the danger connected with postoperative strict rest in bed, which favors

thrombosis. Operative treatment of detachment of the retina is contraindicated in patients over 70 years of age in whom disturbance of the blood circulation exists or disposition to thrombosis is suspected.

K. L. STOLL.

FLOATING LID OF A HOLE IN THE RETINA ASSUMING THE ASPECT OF AN OPACITY IN THE VITREOUS; OBSERVATIONS ON LATENT RETINAL FORAMINA: REPORT OF CASES. A. VOGT, Klin. Monatsbl. f. Augenh. **92: 577** (May) 1934.

Vogt reports on three cases of traumatic tear in the lower portion of the retina which remained latent for a period before general detachment of the retina. The periods of latency were nine months, from three to four years, and eleven months, respectively.

In two other cases a spontaneously formed hole of considerable size in the retina remained latent. Detachment of the retina did not follow even after the lid of the hole became totally separated and floated in the vitreous in the shape of a whitish opacity, which appeared dark in regressive illumination. Judging by shreds of vitreous which adhered to the floating lids, Vogt considers the possibility of a relation between the lids and the structure of the vitreous; jerking motions of the latter may be instrumental in tearing off the lids. Both lids showed a central hole, the origin of which could not be explained; examination with red-free light did not reveal cystoid degeneration in the floating lids. Floating lids may facilitate the finding of a retinal tear or foramen. His surgical results in these cases prompt Vogt to the opinion that a foramen presenting well adherent edges which does not lead to detachment of the retina does not necessarily demand an operation. Surgical procedures may be resorted to after a detachment has occurred. He thinks that foramina which do not produce a detachment are more frequent than has been suspected. A table with nine colored pictures is appended.

K. L. STOLL.

Trachoma

TREATMENT OF TRACHOMA BY THE INSTILLATION OF AN AUTOGENOUS VACCINE. PEREZ LLORCA, Rev. cubana de oto-neuro-oftal. **5: 262** (Sept.-Oct.) 1933.

The work of Mario Esteban is quoted (*Arch. hispano-am. de oftal.*, February 1933). He utilizes the exudate expressed from trachomatous follicles, inactivated at a temperature of 60 C. This vaccine is instilled into the same eye. Of forty-nine patients who were free from any other treatment it was possible to follow up forty-two. Of these, thirty-four were cured and seven improved, and one had a recurrence. The treatment is less painful and more innocuous than that by other methods which have come into more or less general use, but the efficacy of which must be regarded with many reservations.

Llorca has used this form of treatment in but five cases, which are still active. Although he cannot as yet speak of a cure, he has noticed a markedly beneficial effect in the eye into which instillations were

made and also in the other eye. Although realizing that statistics per se are frequently misleading, he feels that this is a step in the right direction.

S. L. RHODE.

BIOMICROSCOPIC AND HISTOLOGIC STUDIES OF TRACHOMA VERUM CORNEAE. W. W. TSCHIRKOWSKY and L. A. DYMSCHITZ, Arch. f. Ophth. **132:** 239 (April) 1934.

The literature concerning the histology and pathogenesis of trachomatous pannus is reviewed. The authors have been interested in the so-called true trachoma of the cornea which is characterized by the presence of true trachoma follicles in the cornea. The slit-lamp picture of those follicles is as follows: They are located within the pannus and measure from 1 to 2 mm. in diameter. They do not raise the surface of the cornea much. They are semitransparent, gelatinous and gray in appearance. They invade the deeper layers of the cornea. They are separated from each other by blood vessels.

Four cases are reported in detail. The authors conclude that trachoma corneae verum can occur in any stage of trachoma. It has a very characteristic clinical picture. Paschoff's description of it agrees in every respect with the observations of the authors of this paper. The pannus in such cases of trachoma corneae verum is, without any doubt, a local manifestation of the typical trachomatous process in the cornea.

P. C. KRONFELD.

Tumors

EPITHELIAL CYST IN THE POSTERIOR CHAMBER. C. W. TOOKER, Am. J. Ophth. **17:** 41 (Jan.) 1934.

Tooker gives the following summary of a case of epithelial cyst in the posterior chamber: "Seventeen months after a penetrating wound in the ciliary region of the right eye of a boy, a tumor developed in the posterior chamber. It was visible in the pupillary area coming up from behind the iris. The eye was removed and sections made from it. The tumor was an epithelial cyst of the posterior chamber. The explanation of the development of the cyst that is most consistent with the clinical history and the pathologic anatomy, is the supposition that at the time of the injury epithelial cells were implanted at the root of the iris or in the ciliary body, and that they proliferated forming a cyst which extended into the posterior chamber."

W. S. REESE.

REPORT OF AN UNUSUAL CASE OF ORBITAL TUMOR. W. H. GOW, Brit. J. Ophth. **18:** 520 (Sept.) 1934.

A girl, aged 18 years, had first noticed an increase in the size and prominence of the left eye when she was 12 years old. The eye was blind. There had been a gradual but slow increase in the size of the tumor. The orbit was exenterated. The tumor measured in circumference in its anteroposterior plane 21 cm.; in the lateral plane, 18.8 cm. The anteroposterior diameter was 7.5 cm., and the lateral

and vertical diameters were 5.5 cm. On section it was found to be a cyst containing 90 cc. of a thick brownish fluid.

The wall in the posterior half of the cyst was fairly uniform in thickness, but in the anterior half it was thickened irregularly with the remnants of the eyeball, the thickened cornea and conjunctiva and parts of the lid. The wall of the cyst anteriorly was similar to that elsewhere but in front of it lay the collapsed eyeball, the cornea covered by a cornified, scaly mass, and thickened lids.

The cyst originated posterior to the eyeball. The lining was composed of squamous epithelium, and the cyst was therefore an epithelial or dermoid cyst. Gow was not able to find in the literature any mention of a tumor similar to this one.

The article is illustrated.

W. ZENTMAYER.

THE DIAGNOSIS AND PROGNOSIS OF INTRA-ORBITAL TUMORS. E. JESSEL, Arch. d'opht. **51**: 232 (April) 1934.

Jessel draws attention to the special characteristics of the proptosis and some distinguishing ophthalmoscopic observations. The main point that he makes in regard to the exophthalmos is that the direction of the displacement of the eye is of localizing value. It may sometimes be straight forward, sometimes to one side. In regard to the ophthalmoscopic findings he has observed choked disk or a consecutive atrophy in twelve of eighteen cases. The elevation of the disk was found to be much greater on the nasal than on the temporal side, more so than in choking due to intracranial tumor. In four cases the difference amounted to between 4 and 7 diopters. He states that this observation needs confirmation. A second ophthalmoscopic observation was that of folds in the retina. These are almost always horizontal, only slightly elevated, and of an extent equal to the distance between the disk and the macula. They are most often found in the retinal area which lies between the superior and inferior vessels, principally between the disk and the macula. He suggests that these folds appear when the tumor develops too rapidly to allow the eye to adjust itself to the pressure. He has never seen a detachment develop from them. The early loss of vision which occurs is sometimes due to an increase in hyperopia, more rarely to myopia (produced by pressure on the sides of the globe) and sometimes to astigmatism. In the latter part of this report the results of treatment are reported. Surgical intervention was resorted to in fourteen instances. There were eight Krönlein operations, five orbitotomies and one primary exenteration. In eleven cases, in some of which operation had been performed, treatment with x-rays was used in seven, with x-rays and radium in three, and with radium alone in one. Of the fourteen patients operated on four were cured (two with angiomas, one with dermoid cyst and one with tumor of the optic nerve sheath). Four showed improvement (one with angioma, one with neurinoma and two with sarcomas). Six showed no improvement and received no benefit from radiotherapy after operation. Of four patients not operated on, one received no treatment because the sarcoma was metastatic. The remaining three were treated with x-rays or radium (in one an angioma improved on treatment with x-rays; in two a

sarcoma and a carcinoma were uninfluenced by x-rays). Jessel feels that his statistics prove that surgical treatment yields good results in benign tumors and that it is wise to employ radiotherapy in addition in the treatment of malignant tumors.

S. B. MARLOW.

NEURINOMA OF THE ORBIT PRESENTING CLINICAL SYMPTOMS OF A TUMOR OF THE OPTIC NERVE: REPORT OF A CASE. R. W. MÜLLER, Klin. Monatsbl. f. Augenh. **92:** 592 (May) 1934.

A girl, aged 16, presented symptoms of a tumor of the optic nerve: amaurosis of the left eye at the onset of exophthalmos, temporal pallor of the disk, and left frontal and occipital headache. The protrusion of the globe increased from 3 to 7 mm. within a year, and total optic atrophy developed instead of choked disk. Operation after Krönlein revealed a neurinoma of the orbit which could not be totally removed. Exenteration of the orbit, done a month after the first operation, showed that the tumor masses extended into the foramen opticum, and that they were adherent to the dura mater. Roentgen treatments were given, and no recurrence was observed a year after the operations.

The origin of the tumor could not be recognized, but Müller considers it plausible that it arose from the nerves in the dural sheath of the optic nerve. He refers to two similar cases, one published by Jessel, the other by Wohlwill. Neurinoma of the optic nerve itself can be excluded for evolutionary reasons. The presence of cysts and infiltrating growth, not sarcomatous, was pointed out especially.

K. L. STOLL.

Uvea

ACUTE IRITIS AND DENTAL INFECTION. H. LAGRANGE and P. MARQ, Bull. Soc. d'opht. de Paris, March 1934, p. 149.

A 40 year old man had had acute iritis of the left eye for about fifteen days. Visual acuity was 1/3. The condition was aggravated by intravenous injections of silver cyanide. Dysentery (diarrhea) and gingivitis ensued. Mercurials and intravenous injection of sodium salicylate aggravated the iritis. The Wassermann reaction was negative. Complete examination of the lungs, intestines and genito-urinary system revealed no abnormal condition. A stomatologist suggested and had taken x-ray pictures of the teeth. When periosteal and alveolar disease was eradicated, the entire gamut of symptoms promptly subsided. The importance of the teeth as a source of infection is emphasized.

L. L. MAYER.

Therapeutics

OUR EXPERIENCE WITH MEDICAL OPHTHALMODIATHERMY DURING TWO AND A HALF YEARS. CEPERO GARCIA and COMAS CESPEDES, Rev. cubana de oto-neuro-oftal. **6:** 29[illegible] (Nov.-Dec.) 1933.

Garcia and Cespedes give a brief review of a series of interesting results which have been obtained by medical and surgical use of

diathermy. They describe in a general way the results of diathermic treatment in widely varied ocular conditions, among which results stand out most prominently the antiphlogistic, resolutive, analgesic and tropic effects. Attention is called to the great advantage of using diathermy surgically in place of radium and the x-rays because of the more exact measure of the dosage, the greater accessibility of involved regions with the treatment and consequently the less destructive effect on the eyeball. The article contains a statistical summary of 210 cases in which treatment by this means was given with, in the main, very satisfactory results.

S. L. RHODE.

Society Transactions

EDITED BY DR. JOHN HERBERT WAITE

AMERICAN OPHTHALMOLOGICAL SOCIETY

Seventieth Annual Meeting, July 9, 10 and 11, 1934

W. GORDON M. BYERS, M.D., *President*

J. MILTON GRISCOM, M.D., *Secretary*

INCLUSION BLENNORRHEA. DR. S. HANFORD MCKEE, Montreal, Canada.

In 1907 Halberstaedter and Prowazek described, in the epithelial cells in cases of trachoma, inclusions which they believed represented a living parasite and the cause of trachoma. Chlamydozoa have been found in other diseases, such as ophthalmia of the new-born, swimmer's conjunctivitis, conjunctivitis of swine fever and epitheliosis desquamativa conjunctivae of Samoa. This paper concerns a series of 23 cases of ophthalmia neonatorum, both gonorrheal and nongonorrheal. A possible etiologic explanation of the inclusions is given.

DISCUSSION

DR. C. S. O'BRIEN, Iowa City: From a study of 12 patients Thygeson worked out the life cycle of this organism, which has two stages: He believes that the elementary body (first stage), which is a small filtrable virus, is the infective stage. The elementary body grows and forms the larger initial body (second stage), and then the initial body divides and continues its division until eventually, within forty-eight hours, the parasite gets back to the elementary body stage, and then the virus is in a position to infect new cells. Thygeson has been able, with a collodion filtrate, to produce the disease in three human eyes, his own eye being one of these, and he has also produced it in the eyes of monkeys. The only difficulty, apparently, is that of concentrating the virus. One must have a case in which the elementary and initial bodies are abundant. The bodies are recovered by means of a supercentrifuge and then by filtration through an Elford collodion filter, which has a measurable pore size, and which does not pass bacteria.

DR. MARTIN COHEN, New York: When Halberstaedter and Prowazek brought out the inclusion in epithelial cells as possibly the etiologic factor in trachoma, Noguchi and I studied the trachoma bodies for eight years at the Rockefeller Institute. We studied inclusion bodies in various types of follicular conjunctivitis, and in 1911 we came to the conclusion that we were dealing with an independent disease. A report of this work was published in the ARCHIVES (**40: 1**, 1911) We called the disease "inclusion cell conjunctivitis." With mild treatment, the capillary appearance of the tarsal conjunctiva usually lasts four months, and then there is retrogression, the conjunctiva becoming normal in most instances. In a case which I had under observation for

fifteen years there developed unilateral ptosis and definite cicatrization of the palpebral conjunctiva. Another case was studied in which Noguchi and I found these inclusion bodies over a period of seven years; this case terminated with cicatrization of the conjunctiva but without corneal involvement. The question of the inclusion body has not been entirely settled, and I think it is not possible to accept any theory unless an organism can be isolated which is morphologically identifiable with the inclusion bodies, and which can reproduce the disease and which can be recovered from the eyes experimentally infected.

ESSENTIAL SHRINKAGE OF CONJUNCTIVA IN A CASE OF PROBABLE EPIDERMOLYSIS BULLOSA DYSTROPHICA AQUISITA. DR. MARTIN COHEN, New York, and DR. MARION B. SULZBERGER, New York.

This paper, with the discussion, appears in full in this issue, p. 374.

MEDICAL TREATMENT OF SENILE CATARACT: GENERAL AND CONSTITUTIONAL; SPECIFIC AND LOCAL. DR. A. EDWARD DAVIS, New York.

The frequency with which cataract is a cause of blindness is noted, and the importance of preventive treatment both general and specific is discussed with reference to the endocrine glands, hormones, vitamins, physical therapy, ionization and lens antigens.

DISCUSSION

DR. EMORY HILL, Richmond, Va.: Dr. Davis has referred to a paper by my colleague, Dr. Courtney. I should not like an impression to be left with this audience that Dr. Courtney's paper supports the view that cataracts absorb. Both the patients cited had endophthalmitis phako-anaphylactica and glaucoma from swelling of the lens. Both patients endured three operations in order that the glaucoma might be relieved. Subsequent removal of the nuclei of the lens gave satisfactory results.

DR. ALLEN GREENWOOD, Boston: I wish to call the attention of the Society to the fact that blindness from cataract is not quite so frequent as has been stated by various authors. I have encountered many cases of blindness from so-called cataract in which dilation of the pupil enabled one to identify glaucoma and lesions of the fundus or in which the visual field showed defects characteristic of glaucoma.

DR. ALBERT C. SNELL, Rochester, N. Y.: A confrère in a nearby large town has been following the treatment of cataract advocated by Dr. Davis. Many of my patients have gone to him for treatment, and I have seen them before, during and after the treatment. When these patients returned to me the vision had not improved, and the cataract had not retrogressed. I have operated in 50 such cases in the last five years. My observation is that treatment by lens antigen is of no value.

DR. P. C. JAMESON, Brooklyn: One is apt to make a mistake in attributing a certain cure to a certain agent which one has used; the improvement sometimes is a natural occurrence. For three months I have been trying to standardize the dose of thyroxin, U. S. P., used

locally in the eyes of some 25 patients with cataract. It is difficult in three months to form a valid opinion, and in some cases of cataract it is difficult not to make a false or erroneous attribution.

Dr. A. E. Davis, New York: I firmly believe that if all cataracts were seen early and general treatment given, necessary metabolic tests made, the proper dietary regimens instituted and local and specific treatment given, the number of operations for cataract would be reduced at least one half or three quarters. It is very much more trouble to give nonoperative treatment than to put a patient on the table and remove the cataract, but if in this era of preventive medicine the trouble were taken I think cataract extractions could be prevented.

Lipin Interstitial Keratitis. Dr. Parker Heath, Detroit.

This paper, with the discussion, will be published in full in the Archives.

Salzmann's Nodular Corneal Dystrophy: Its Pathologic Process and a Suggested Therapy. Dr. E. V. L. Brown, Chicago, and Dr. Dewey Katz, Chicago.

This paper, with the discussion, will be published in full in a subsequent issue of the Archives.

Occurrence of Ciliary Processes on the Iris. Dr. Algernon B. Reese, New York.

This paper concerns the embryology, histology, frequency and possible clinical significance of this congenital anomaly.

Stigmatoscopy. Dr. Walter B. Lancaster, Boston.

An understanding of the formation of images by the eye does not require formulas. The best way to study the formation of images by a lens is to focus the bundle of rays from a point source of light on a screen, and by shifting the screen forward and back, make a direct study of the constitution of the bundle of rays. The teaching of physiologic optics should be based on laboratory work with lenses by the method of stigmatoscopy, and on subjective stigmatoscopy, rather than on mathematical formulas.

DISCUSSION

Dr. William E. Shahan, St. Louis (discussing the operation of an optical bench and instrument which he designed, and the waste of time in trying to teach students with formulas): If the student is asked to put a plus 10 biconvex lens into the holder, and then asked to move the object about until the image is formed, he will find that the image is formed when the object is 10 cm. from the lens. If he then puts in a plus 10 planoconvex lens, he has to move the object a little nearer in order to define the image. Likewise he can study just how much stronger a lens becomes as it changes from a convex one to a meniscus and the astigmatic effect of rotating a lens. Should one spend an entire year using thousands of seven-place logarithms to work this out mathematically, it would be without gaining as lucid an understanding as the apparatus will afford.

DR. WALTER B. LANCASTER, Boston: It is difficult to keep the student interested in the study of optics when the subject is treated with logarithms or by other mathematical methods, but it is not difficult when he is shown the practical application to his everyday work.

GLAUCOMA ACCOMPANYING NAEVUS FLAMMUS. DR. EDWIN BLAKESLEE DUNPHY, Boston.

To the 61 cases previously reported in the literature, 2 new cases, 1 with histologic studies, are added. Certain aspects of other cases are discussed, along with the theories of nevus formation and the production of glaucoma.

DISCUSSION

DR. H. H. TYSON, New York: The salient point of interest in such cases is the condition of the blood vessels of the uveal tract, which are usually dilated, with clumps of vessels on the iris in the periphery near the angle. The vessels of the circulus iridis minor, usually not visible in the normal eye, can be seen extending around the entire circumference of the iris. In examining the cases a more extended view of the angle can be obtained with the gonioscope than with the slit lamp. In the 2 cases which I reported in 1932 I found that the internal administration of the fluorescein test gave an interesting result. In both cases the aqueous in the glaucomatous eye on the side with the nevus gave a fluorescein greenish reflex, while in each normal eye no staining of the aqueous occurred, showing an increased permeability of the vessels in the affected eyes. In one case recurrent hypertension was relieved permanently by a successful trephine operation, while in the other case a successful result was obtained by iridectomy. In both cases the iris angles were free from adhesions.

DR. C. S. O'BRIEN, Iowa City: In 1933 Dr. Porter and I reported a case showing the extent of the nevus and its distribution over the area of the fifth cranial nerve and over the ophthalmic division. In February 1934 a woman 24 years of age was examined who had a nevus covering the entire left side of the face with involvement of the lip, both eyelids, the conjunctiva and the caruncle. The slit lamp showed aneurysmal dilatation of the vessels at the limbus, obliteration of the iris markings, and vessels which ran in an irregular manner over the anterior surface of the iris. The pupillary reactions were practically absent, and the patient had only bare perception of light. There was no enlargement of the globe. The fundus could not be seen an account of cataract. The tension with Schiötz' instrument was 47, and epinephrine bitartrate lowered the tension to 40.

PECULIAR CONTRACTION OF THE VISUAL FIELDS ASSOCIATED WITH SYPHILIS OF THE CENTRAL NERVOUS SYSTEM. DR. W. I. LILLIE, Philadelphia.

Since tryparsamide has been used for the treatment of syphilis of the central nervous system, renewed interest in the ocular changes in cases of syphilis has been stimulated. Because of the reported untoward effects of tryparsamide on the optic nerves, taking of the perimetric fields before tryparsamide therapy is instituted has been a routine at the Mayo Clinic in all cases of syphilis of the central nervous system.

Peculiar contraction has been found chiefly in the upper and lower peripheral portions of the visual fields, with a resulting palpebral slitlike field of vision. The central visual acuity is usually unimpaired, and the patient is rarely aware of any visual defect. This field defect has been observed regardless of the type of therapy used, and has been frequent enough in syphilis of the central nervous system to be almost pathognomonic of this disease. It is still a moot question whether the therapy produces the defect of the visual fields, or whether it is due to syphilis alone.

THREE UNUSUAL CASES OF FOREIGN BODIES IN AND ABOUT THE EYEBALL. DR. FRED TOOKE, Montreal, Canada.

In each case the foreign body had been present for a long time and was nonmetallic. In 2 cases the history of the original accident was elicited only after the character of the foreign body was disclosed.

DISCUSSION

DR. WILLIAM H. WILMER, Baltimore: Dr. Wilmer spoke of a foreign body in the eye which gave rise to repeated attacks of iridocyclitis, without evidence of general or focal sepsis. Although x-ray photographs disclosed no shadow, a glass foreign body was suspected. The glass particle was found by feeling and not by sight, and was removed intact with a forceps. In two weeks the patient's eye became perfectly quiet.

DR. P. J. LEINFELDER, Iowa City: A man, 48 years of age, fell and a small splinter of wood pierced his left lower eyelid. Three weeks later the vision in the left eye was 6/30; there was a proptosis of 13 mm.; the eye was immobile, and papilledema was present. A fixed hard tumor was palpable in the upper inner angle of the orbit. The following day, after a severe chill, the temperature rose to 106.4 F. Incision through the lower lid yielded pus containing hemolytic staphylococci, nonhemolytic streptococci and influenza bacilli. The proptosis persisted, and for several weeks the temperature was elevated, but blood cultures were negative. On incision into the tumor in the upper nasal angle of the orbit a small amount of pus was recovered. Vision rapidly deteriorated because of consecutive optic atrophy. After seven weeks of hospitalization the patient was discharged; the temperature was normal, but there remained 9 mm. of proptosis. One month later a piece of wood was discharged from a draining sinus in the upper lid, and the wound healed. Some proptosis was still present three months after admission.

A man, aged 34 years, was admitted to the hospital on account of loss of vision in the left eye evidently due to a ruptured choroid and chalcosis bulbi. He had been hit in that eye with a baseball when he was 14 years of age, and vision had been poor since that time. After persistent questioning the patient remembered that previously a dynamite cap had exploded in his hand, causing numerous flesh wounds, but he could not remember any ocular injury. Careful ocular examination revealed no scars, and an x-ray photograph demonstrated no foreign body. The lens was golden in color and showed the typical sunflower type of anterior subcapsular opacities.

Dr. John W. Burke, Washington, D. C.: For the removal of small particles of glass in the anterior chamber the first essential is adequate intense illumination, and the second essential is incision by the method of Reese.

Sympathectomy for Retinitis Pigmentosa. Dr. Alexander E. MacDonald, Toronto, Canada, and Dr. K. G. McKenzie, Toronto, Canada.

This paper, with the discussion, will be published in full in a subsequent issue of the Archives.

Iris Inclusion Operations for Glaucoma, with Special Reference to Iridotasis. Dr. C. A. Clapp, Baltimore.

The technic of the operation as performed by Dr. Clapp is outlined. In certain types of glaucoma, especially the congenital type, a modified iridotasis in two stages is advised. The advantages and disadvantages of this operation are discussed, and the details and importance of the after-treatment stressed.

DISCUSSION

Dr. Allen Greenwood, Boston: In glaucoma of low tension I feel that there is no operation quite so satisfactory as that by trephine. Good results in the various operations for the production of a filtering cicatrix depend on the use of massage for a long time after the operation. For glaucoma of moderately high tension, a simple iridotasis is undoubtedly very suitable. In cases of this type I prefer a combination of Lagrange's operation (sclerecto-iridectomy) and iridencleisis, which involves the removal of a tiny part of the sclera with the Lagrange punch or scissors and cutting of the iris sphincter to prevent return of a tongue of iris into the anterior chamber.

Atropine is essential after the use of any operation to produce a filtering cicatrix. In some cases of glaucoma of low tension these operations will not always reduce tension, even when the eye is massaged fairly vigorously.

Dr. David Harrower, Worcester, Mass.: I have done iris inclusion, following the method of Borthen, in about 50 cases. It is important to have the incision small to avoid the danger of getting too large a bleb.

Dr. H. S. Gradle, Chicago: I want to ask Dr. Clapp about the effect of the operation in that fairly advanced type of simple glaucoma in which the visual field has been contracted to within from 5 to 10 degrees of the center of fixation—the type resulting in a sudden loss of vision after most of the usual cutting operations.

Dr. William H. Crisp, Denver: I believe the important part of the technic is getting down beneath all the subconjunctival tissue at that point where the little tip occurs between the cornea and the sclera at the limbus, and carrying the keratome in at this point. I believe it to be of importance to turn the iris epithelial side out, so that the black surface lies well displayed. I have never found it necessary to use atropine after these operations, as the patient usually has no pain, or

no appreciable pain, and even if there is a little irritation, it is not severe. Not merely from my own experience, but from a rather extensive review of the literature, I believe it can be said that sudden loss of vision after an iridencleisis is practically unknown.

DR. C. A. CLAPP, Baltimore: In reference to Dr. Greenwood's question: These operations were not all on eyes with high tension; some were done on eyes with low tension. In reply to Dr. Gradle's question: The field changes did not show a sudden loss, and the tension remained low. Concerning the question of cataract following operation: I feel that it does not develop half so frequently after iris inclusion as it does after trephining.

CYCLODUCTION. DR. F. H. VERHOEFF, Boston.

Cycloduction is a normal function of the eyes. Lines, single or multiple, are feeble stimuli to cycloduction. Diameters, one before each eye, displaced from the vertical are almost without effect as stimuli. Printed words in parallel rows displaced from the horizontal are more effective as stimuli to cycloduction than are distant objects. Measured from the positions which the eyes assume relative to each other when there is binocular fixation but no stimuli to cycloduction, the maximum range of esocycloduction with stimuli of printed words is about 5 degrees and the maximum range of exocycloduction is about 4.5 degrees, obtained by gradually increasing the angular displacement of the stimuli within a period of thirty minutes. In two minutes the maximum range of esocycloduction is about 2.75 degrees, and the maximum range of exocycloduction is about 1.75 degrees. The maximum cycloduction is always considerably less than the angular deviation of the stimuli required to produce it. Even after prolonged cycloduction the eyes return in a few minutes to their usual positions when the stimuli are withdrawn. The initial speed of cycloduction is low—about 0.5 degree per second. The speed of exocycloduction is somewhat greater than that of esocycloduction. In ordinary vision cycloduction overcomes about half the slight exocyclotropia that usually exists when there are no stimuli to cycloduction, and probably prevents the gradual development of serious torsional deviation. In reading, cycloduction no doubt tends to keep the "horizontal" corresponding retinal meridians horizontal. Otherwise, owing to its low speed, it probably plays little if any active part in vision.

DISCUSSION

DR. WALTER B. LANCASTER, Boston: Accurate thinking and logical conclusions require accurate use of terms with precise meanings. Ocular movements are complicated, and it facilitates talking and thinking about them if accurate terms are used. Dividing ocular movements into two groups, one has monocular and binocular movements, the former consisting of adduction, abduction, rotation up and down and torsion, and the latter of conjugate and dysjunctive movements. The conjugate movements are the ordinary ones in which both eyes move together, and the dysjunctive are those in which the eyes move in opposite directions. It is common to confuse convergence and adduction—two very different matters. Conjugate movements to the right and left, which are significant in a good many neurologic conditions, should be spoken

of as levorotations and dextrorotations. Convergence and divergence should be spoken of as vergences and not ductions.

When the head is turned toward one shoulder, the eyes show conjugate movements. On the other hand, there are dysjunctive movements of torsional character, and there are those which are needed in adjustments. The adjustments in the horizontal line are done by dysjunctive movements. In the same way a little overconvergence is needed if there is cyclophoria, and that is what Dr. Verhoeff has shown is taking place—a slight amount of cyclophoria with a certain amount of cyclovergence.

Dr. F. H. Verhoeff, Boston: This question of terminology is vexatious. I think there is much in favor of the term "cycloduction" rather than "cyclovergence." As to vergences, there are divergences and convergences which are not abductions and adductions.

A Factor in the Production of Divergence Increase with Near Vision. Dr. F. Herbert Haessler, Milwaukee.

An analysis of clinical measurements on almost 200 pairs of eyes revealed no correlation between the esophoria or exophoria measured at 5 meters, 50 cm., 33 cm. and 25 cm. respectively, on the one hand, and a balance of divergence and convergence on the other. This is not surprising when one considers that the maximum divergence or convergence possible for a pair of eyes may itself be the resultant of divergence and convergence effort. It seemed desirable to seek for a fundamental element in these complex muscular activities. It was found that the maximum divergence possible is greater when the eyes fix at short range than when they fix for distance, and that this divergence is proportional to the percentage of accommodation which is used for the distance of fixation. The correlation, though not absolute, is true for a large enough part of the entire material to seem convincing, and is also true to as great a degree of accuracy as might be expected from the clinical measurements in question.

DISCUSSION

Dr. Walter B. Lancaster, Boston: Does Dr. Haessler refer to relative divergence or absolute divergence in his measurements? Is the divergence relative to the point of fixation, or is it an absolute amount of divergence?

Dr. J. W. White, New York: I should like to ask Dr. Haessler how he measured the accommodation in these cases. Since the muscle balance of presbyopes is almost as good as that of younger patients, I am not willing to discard the presbyopes without knowing the amount of accommodation and the amount of muscle balance difference.

Dr. A. D. Prangen, Rochester, Minn.: I wonder if Dr. Haessler's theme is that there is no common denominator between divergence and convergence and accommodation. Recently at the Mayo Clinic we felt that there is such a common denominator between accommodation and convergence, and we are inclined to feel that divergence is rather a passive and subservient function. It seems to me that there is a definite balance connecting the three functions, rather than the two, as we had formerly thought.

Dr. Alexander E. MacDonald, Toronto, Canada: Dr. Haessler has shown that there is an agreement between accommodation and convergence and divergence. In a paper I read at the International Congress of Ophthalmology at Amsterdam I showed that they could be dissociated. If stereoscopic pictures are taken they can be fused by divergence, and while the eyes are diverging they can accommodate sufficiently to get the picture in good focus.

Dr. F. Herbert Haessler, Milwaukee: In reply to Dr. Lancaster: I measured these functions as the maximum prism which could be overcome, the maximum prism which could be placed before the eye and the patient still retain binocular single vision. As to Dr. White's notion that I discarded presbyopes, I merely made the point that a relationship exists between accommodation and the balance of convergence and divergence, the result of which is divergence of the visual axis. Most of these curves do not concern presbyopes, because one uses 4 diopters of accommodation. If that line is overstepped there are not enough points of measurement to make a graph. I think the idea of Magnus' postural reflex also has some relation to the points taken up by Dr. Prangen and Dr. MacDonald. The reason I spoke of the postural reflex is because, without the limits of these data, if one puts on spheres and again tests the amount of divergence of the visual axes, one does not change the mathematical relationship. From that I conclude that it is not a direct stimulation, such as occurs on the application of an electric current to a nerve or muscle preparation, but rather a habit which has formed during the course of years and cannot be upset during the course of months.

Superior Oblique and Inferior Oblique Advancement. Dr. John M. Wheeler, New York.

In the literature there is apparently no reference to operations for shortening the inferior oblique and the superior oblique muscles of the eyeball. It has been found feasible to operate on the inferior and superior obliques, and a technic is described for advancing each of these muscles.

DISCUSSION

Dr. W. B. Lancaster, Boston: In operating in the vicinity of the insertion of the superior oblique, I have found it an advantage to do an external canthotomy, which enables one to obtain better exposure with less pulling of the eyeball.

Dr. J. H. Dunnington, New York: I have advanced the inferior oblique as described by Dr. Wheeler. The patient presented 20 centrads of hyperphoria before operation; this was reduced to 6 afterward, with a satisfactory correction.

Surgical Treatment of Hyperphoria and Hypertropia, with Especial Reference to Orthoptic Training. Dr. Conrad Berens, New York; Dr. Brittain F. Payne, New York, and Dorothy Kern, New York.

Indications, contraindications, the methods used by various authors and our own preference for the operative correction of hyperphoria and hypertropia are considered. Especial emphasis is placed on pre-

operative and postoperative orthoptic training and on the results of the combined surgical and orthoptic treatment of patients with hyperphoria and hypertropia.

SURGICAL OPERATION ON THE RECTAL MUSCLES: SELECTION OF OPERATIVE PROCEDURES BY DIFFERENTIAL DIAGNOSIS. DR. AVERY D. PRANGEN, Rochester, Minn.

Two considerations are essential: (1) when to operate, and (2) what to do. An endeavor is made to find some means of evaluating and utilizing established operative procedures. It is felt that all methods, when properly selected and applied, must have their good points. With so many varied technics advocated, some differential basis must exist for selecting the method best adapted to the case at hand. Indications and contraindications for operation are discussed. When nonoperative management has failed and the defect is becoming worse, with amblyopia ex anopsia and progressive muscular dysfunction developing, surgical intervention is indicated at any age. No one operation is ideal for all cases. A common theme is found connecting differential diagnosis and the choice of operation for muscular imbalance. Careful scrutiny makes possible a more exact classification of muscular anomalies. Such differentiation permits the election of various surgical procedures and the use of each to its best advantage.

DISCUSSION

DR. J. H. DUNNINGTON, New York: When the indications demand that operation should be done, one should operate regardless of the age of the patient, but I think that one cannot stress too strongly the necessity for careful preoperative diagnosis. Recession is not a panacea for all muscular ailments. It seems that many ophthalmic surgeons are drawing away the muscle so far that they might as well do a complete tenotomy.

SOME OBSERVATIONS AS TO INDICATIONS FOR ADVANCEMENT AND KINDRED OPERATIONS. DR. P. CHALMERS JAMESON, Brooklyn.

This paper was published in full in the January issue of the ARCHIVES, p. 3.

THE PATHOGENESIS OF SOME INTRA-OCULAR OSSEOUS TISSUE: TRUE METAPLASIA IN THE EYE. DR. HARVEY D. LAMB, St. Louis.

The formation of bone commonly found along the inner surface of the choroid and less often in the same relation to the ciliary body in old inflamed eyeballs is developed in a considerable degree within connective tissue derived, in the first position, from the retinal pigmented epithelium and in the second, from the pigmented epithelium of the ciliary body.

Statements of Axenfeld, Leber and E. von Hippel on the development of connective tissue-like formations from the cyclitic and retinal epithelia are quoted. The composition of foci of such metaplasia is described as observed in cases of exudative retinitis, old ectogenous uveitis and old contusions. In one eye with prenatal uveitis, from a

patient 62 years old, not only spongy bone with fatty marrow but considerable numbers of bone marrow cells had developed along the inner surface of the choroid. Lastly, brief reference is made to the similar observations as regards this metaplasia by W. A. Brailey, Hunterian professor of the Royal College of Surgeons in 1885-1886 and curator of the Royal London Ophthalmic Hospital Museum from about 1875 to 1882.

DISCUSSION

DR. DEWEY KATZ, Chicago: For a long time it has been recognized that bone tissue will form in areas where vascularization is poor. Many years ago it was found that tying off the arteries and veins of the kidneys would produce necrosis of the renal tissue, then calcification and finally an osteogenic process. It was noted in these experiments that the ureter and pelvis of the kidney were not affected in view of the fact that they are supplied by the ureteral artery. Recent experiments seem to indicate two components in the osteogenic process, namely, transplanted epithelium and surrounding fibroblasts which show basophilic degeneration and later osteogenic properties.

THE OCULAR MANIFESTATIONS IN EIGHTEEN VERIFIED CASES OF ADAMANTINOMA OF THE HYPOPHYSEAL STALK. DR. T. B. HOLLOWAY, Philadelphia.

An analysis of the ocular signs and symptoms of adamantinomas of the hypophyseal stalk is discussed. Reference is made to certain other groups reported in the literature. This type of tumor, as compared with pituitary adenoma, gives a higher incidence of choked disk and homonymous hemianopia. A majority of the patients with choked disks were under 15 years of age.

UNILATERAL EXOPHTHALMOS. DR. C. S. O'BRIEN, Iowa City, and DR. P. J. LEINFELDER, Iowa City.

Unilateral exophthalmos is ordinarily due to orbital changes, either inflammatory or noninflammatory. Among 75 consecutive cases there were 32 of the former and 43 of the latter type. The most common cause of proptosis was malignant tumor of the orbit, either primary, secondary or metastatic, e. g., sarcoma, carcinoma or neoplastic disease of the hematopoietic system. Benign tumors were rare, such as meningioma, cavernous hemangioma, neurofibroma, chondromyxoma and adamantinoma. Other causes of noninflammatory nature were hemorrhage following trauma, arteriovenous aneurysm and unilateral axial myopia. Proptosis associated with orbital inflammation occurred most frequently in the presence of suppurative sinus disease or panophthalmitis; it also occurred with cavernous sinus thrombosis, osteomyelitis, periostitis and actinomycosis.

Diagnosis was difficult in noninflammatory conditions and was made only by examination of tissue removed at biopsy. A visible or palpable tumor was often present, and the globe was frequently displaced laterally or vertically. Rapid onset, pain, edema and even elevation of temperature and leukocytosis were prominent symptoms in inflammatory cases.

A Case of Chloroma with Orbital Involvement Locally Benefited by Roentgen Therapy. Dr. Clarence King, Cincinnati.

A boy, aged 9, presented himself with marked left exophthalmos. The results of the ocular and general physical examination are given. A diagnosis of chloroma was made, based chiefly on an examination of the blood. The exophthalmos subsided under roentgen therapy. The patient later succumbed to the general disease and terminal bronchial pneumonia. The gross and microscopic postmortem observations are summarized.

DISCUSSION

Dr. P. J. Leinfelder, Iowa City: I have found that tumors of the blood-forming organs are invariably fatal. They are divided roughly into two groups: (1) the acute leukemias, those of short duration and rapid termination, and (2) the chronic leukemias, which progress for three, four or five years and then terminate in death. The use of the x-rays in these conditions is purely palliative, and is actually destructive in the case of acute disease. The boy whose case has been discussed had leukemia acuta, the white blood cell count on admission being around 35,000. Within two weeks after roentgen therapy the child succumbed to the disease. Almost immediately following the roentgen treatment the white blood cell count rose, rising eventually to 200,000 prior to death. This treatment relieves the pain in chronic cases, but it lowers the basal metabolic rate and decreases the size of the spleen or any tumor that may be treated. The blood picture in these conditions is often a serious problem to the hematologist; it is not always possible to distinguish whether the tumor is myelogenous or lymphogenous.

Association of Optic Neuritis, Facial Paralysis and Facial Hemiatrophy. Dr. Edward A. Shumway, Philadelphia.

This paper, with discussion, was published in full in the January 1935 issue of the Archives, p. 8.

Arachnodactyly (Dystrophia Mesodermalis Congenita, Typus Marfanis; Marfan's Syndrome; Dolichostenomelia). Dr. Ralph I. Lloyd, Brooklyn.

This paper, with the discussion, will be published in full in a subsequent issue of the Archives.

Pathologic Changes in Anterior Half of Globe in Cases of Obstruction in Central Vein of Retina. Dr. Bernard Samuels, New York.

This paper, with the discussion, appears in full in this issue, p. 404.

Tuberculous and Streptococcic Retinal Hemorrhages. Dr. Charles M. Swab, Omaha.

This paper, with the discussion, will be published in full in a subsequent issue of the Archives.

GERMAN OPHTHALMOLOGICAL SOCIETY

Fiftieth Annual Meeting, Heidelberg, Aug. 6 to 8, 1934

PROF. DR. FREDERICK POOS, Münster, Germany, *Reporter*

ABRIDGED TRANSLATION BY DR. PERCY FRIDENBERG, New York

(*Continued from p. 306*)

Demonstration Session, August 6

DR. MEESMANN, Berlin, *Presiding*

LEICA-STEREO-APPARATUS FOR PHOTOGRAPHY OF THE ANTERIOR SECTION OF THE GLOBE. DR. GRUETER, Marburg.

Cooperating with the Eye Clinic of the University of Marburg, Leitz of Wetzlar has constructed an optical apparatus consisting of two Leica cameras in which the introduction of rings between each camera and its objective allows a picture of the anterior segment of the globe to be taken at short range. In order to insure the requisite stereoscopic effect when the camera is brought so close to the object to be photographed, it was necessary to mount both cameras in such a way that they were connected by means of an intercalated wedge-shaped section under a definite angle. Accurate control of distance is obtained by a focusing telescope. Simultaneous exposure of the films in the two cameras and equal bilateral illumination, adjustable as to direction and intensity, are assured by suitable mechanical appliances. The light rays from a 400 watt bulb are made parallel by condensers and passed through a heat filter. For taking varicolored objects, color filters can be placed in the path of the rays from the illuminating apparatus. Without changing the film holders, a series of 36 takes, each 24 by 36 mm. can be made and enlarged as desired. They show great sharpness in definition of depth, owing to the excellent optical construction, an advantage which was not offered by previous models of stereophotographic cameras.

A NEW APPARATUS FOR TESTING VISUAL ACUITY. DR. THIEL, Berlin.

Accurate determination of vision with the test types in common use is in many cases rendered difficult or impossible through sources of error inherent in the method or, at least, in the mechanical details of the tests.

1. The test chart is presented as a whole to the subject, so that he has the opportunity to note all the signs and to impress them on his memory and learn them by heart.

2. The illumination of most test charts is generally very uneven. In this regard the modern apparatus with translucent milk-glass plates offers a decided advantage. Two round disks of unequal size mounted on the same axis, one behind the other, can be revolved in relation to each other. They are divided into 14 equal sectors. In each of these sectors the individual test figures are arranged radially. Both disks lie

behind a diaphragm with an opening corresponding to the size of the disks. In this "pupil," the test signs appear singly. The smaller disk can be displaced at will in relation to the larger one. The individual objects appear as on a transparency. The illumination starts automatically the moment the disks come to a standstill and test objects present themselves in the aperture. As soon as the disks rotate, the light is automatically cut off. The diaphragm can be slipped off and a different test chart inserted—say one for illiterate patients or children—with the "pot-hooks" or Landolt's rings. It may be mentioned that the apparatus is particularly suited for purposes of instruction when a small disk is used with dots or lines to demonstrate the difference between angular visual acuity and form sense.

ACCESSORY APPARATUS FOR RADIOGRAPHY OF THE SKULL. DR. THIEL, Berlin.

Simple appliances for the facilitation of the placing of the patient when taking the picture and for the fine adjustment of the central rays were shown. 1. The small curved Bucky diaphragm with a stereotunnel holder is attached on hinges to the table. Its inclination can be read off on a staff in degrees. The head, which rests on the diaphragm, is illuminated equally from both sides. 2. The x-ray tube is moved by a lever—a much cheaper and more accurate method than that now in use, allowing simultaneous alteration of distance and angle. This has evident advantages, besides shortening the time elapsing between two stereographic takes. 3. Accurate focusing and centering of the ray are facilitated by an optical arrangement in which a circle, spiderlines or other radiant slit-image is projected perpendicularly on the Bucky diaphragm and the desired part of the skull by means of a plane mirror inclined at an angle of 45 degrees. 4. The sharpness of an x-ray picture is greatly increased, as is well known, by the use of diaphragms. Not only does one have the Bucky as a secondary diaphragm, but has it in the tube, as well. The important point is, however, that the aperture should have approximately the silhouette or outline of the skull itself. On the basis of numerous craniometric measurements, three apertures have been devised for the most important surveys of the skull: one, each, for anteroposterior, postero-anterior and bitemporal exposures. 5. Uniformity of the x-ray picture is particularly difficult of attainment in taking the skull on account of the marked variance in density and thickness of different structures and localities. In bitemporal takes, for instance, the orbit and nasal accessory cavities are generally overrayed to such an extent that finer pathologic changes cannot be seen on the plate. Excessive illumination of the marginal regions can be avoided by the interposition of a graduated metal filter of copper or tin as applied similarly by Pickhan for lateral takes of the pelvis and abdomen in pregnancy. If the opening in the diaphragm is beveled inward gradually, one gets a uniformly progressive filtering of the outer zone of the cone of radiation. In this way, the marginal parts receive a smaller dose of x-rays than the denser and thicker central structures of the skull. X-ray surveys of the skull taken with the graduated filter are noteworthy for their surprising uniformity.

APPLICATION OF METAL-VAPOR LAMP TO OPHTHALMOSCOPY. DR. THIEL, Berlin.

Mercury-vapor lamps of the Osram Company, Berlin, are much more suitable for ophthalmoscopy in red-free light than is the arc lamp, as they radiate just in the desired area of the spectrum. The spectrum of the mercury radiant discharge consists practically, in the visible area, of four lines. The relative sensitivity of the eye for luminosity is particularly high for yellow and green, i.e., for just those colors which are needed most and first of all in red-free ophthalmoscopy. The red contingent is such a small portion of the spectral energy distribution that it is negligible or else can be easily eliminated by a filter. Ultraviolet light, which might have a deleterious effect on the eyes of observer and of subject as well, is absorbed for the greater part of the glass mantle of the mercury-vapor lamp. The glass condenser and the glass filter practically complete this absorption. The intensity of illumination is extraordinarily high, in contrast to that of the Vogt-Zeiss red-free lamp, viz., 2,000 lux (Bechstein) at 30 cm. distance, as compared with 700 for the Vogt-Zeiss lamp. The management of the new apparatus is extraordinarily simple, as it can be directly attached to any alternating current circuit of 220 volts. It requires a short time to attain maximum intensity, and after disconnection the lamp should be allowed to cool off for about five minutes before the current is turned on again.

CLINICAL STUDY OF HETEROTOPIC CONUS. DR. LÖHLEIN, Freiburg.

Löhlein describes the fundus as observed in a particularly striking example of that rare condition extreme ectasia of the posterior part of the globe in its nasal half. The right eye of a woman 31 years of age presented myopia of 20 diopters. The left eye showed myopia varying from 14 diopters in the nasal portion to 6 diopters at the disk and only 2 diopters at the macula. With correction of this slight myopia and a low degree of myopic astigmatism, central vision was brought up to 5/7. The nasal half of the fundus bulged outward, forming a true posterior staphyloma, and in this area there was marked depigmentation. In the temporal portion there was normal distribution of pigment except for a pale band from 11 to 5 o'clock through the entire fundus and paramacular region. The disk was markedly deformed, presenting a superior as well as an inferior conus, and the central vascular funnel was "reversed," i. e., directed from the temporal to the nasal side. The case was manifestly one of ectasia of high degree with an atypical, heterotopic conus like those described by E. Fuchs, von Szily Sr. and Rönne. The peculiar features of this case were the marked anisometropia in favor of the nasal half (12 diopters), the rare simultaneous superior and inferior coni at the disk, and the location of the ectasia, which was not in the foreground of the heterotopic crescents or coni, but in that of the inverse nasally directed vascular funnel. Of clinical interest is the fact that an experienced ophthalmologist had made a tentative diagnosis of detachment of the temporal half of the retina in a highly myopic eye, an erroneous assumption which was indeed rather natural under the circumstances.

EXPERIMENTAL VARIATIONS IN INTRA-OCULAR TENSION. DR. WEYZLICH, Jena.

The tension curves from the right eye of a woman, aged 66, with chronic glaucoma and a shallow anterior chamber demonstrate very strikingly the causal relation between pupillary width and intra-ocular tension as proved by Seidel and Serr. A stay in the dark room of about one hour's duration invariably and uniformly raised the tension from 20 to about 50 mm. of mercury (Schiötz). One hour in the light caused the tension to fall from 50 to 20 mm. of mercury. By experiments with various degrees of illumination it was demonstrated that an increase of tension took place only when the pupillary diameter was somewhat greater than 3 mm. (the threshold value of mydriasis). Even when light was excluded from the affected eye there was a fall in tension as soon as the fellow eye was exposed to light, on account of the consensual reaction of the pupil. If, after the tension had been forced up by a stay in twilight, the patient was made to read in the same light for about a half hour, there was an almost immediate fall in tension, owing to contraction of the pupils associated with convergence. After the tension had gone up in the dark room, a hypodermic injection of morphine (0.01 Gm.) brought about a gradual fall of tension although the patient remained in the dark, owing to the miosis centrally induced by the morphine. After the increase of tension in the dark had been observed repeatedly and shown to be a regular and invariable occurrence, it was noted that this stay in the dark, when instituted about three hours after the injection of morphine, was not followed by increased intra-ocular tension, as the morphine-induced miosis which had ensued prevented the pupil from dilating to or beyond the threshold width of 3 mm. Conversely, tension rose in the light if the pupil had been dilated beyond the threshold width by the instillation of even weak mydriatics—e. g., 1 drop of a mixture of 2 per cent solution of cocaine and a solution of epinephrine hydrochloride (1 : 2,000).

THE ZEISS OPHTHALMOMETER. DR. HARTINGER, Jena.

In this model the adjustment of the opposed images is not effected by varying the distance of the mires or test objects from one another but by altering the angle of image reduplication by means of a special pair of rotating prisms. In place of the doubly refracting prism, a biprism is used, consisting of a ring prism and an intermediate prism of opposite and equal deviating strength. The novel test objects have a number of advantages. They are, to begin with, both of the same green color, thus obviating errors due to parallax from color contrast. The astigmatic effect can be determined by a single turn through 90 degrees, whether the astigmatism is with or against the rule. As a fixation mark, a small bright red light is presented to the eye under examination, which is approximately in the optical axis of the observation apparatus and at about reading distance. This arrangement makes it possible for the eye to remain still for a considerable length of time, which may well be especially advantageous when one is dealing with an aphakic eye. The division markings are amply large, so that they can be read off rapidly and easily as well as with the practically requisite accuracy. The radius of corneal curvature can be determined easily

to within 0.01 mm., corneal refraction to within ⅛ diopter and the axis of the cylinder to within 1 degree. The entire area or "spread" of measurement is extraordinarily wide, extending from about 5 to about 12 mm. radius of curvature. Finally, it is to be noted that the test objects are illuminated by two ordinary 15 watt bulbs which can be connected directly with any light circuit.

MELANOSARCOMA OF THE CHOROID IN A PATIENT WITH CARCINOMA OF THE UTERUS. DR. WAGENMANN, Heidelberg.

The patient complained of diminished vision and presented in the left eye the fundus picture of a new growth of the choroid. In 1928 the uterus had been extirpated for cancer of the cervix, and an ovarian cyst had been removed at the same time. Microscopic examination proved the growth to be an adenocarcinoma. Examination for the later condition showed a recurrence of carcinoma in the vagina, with the same histologic structure as the original carcinoma. Accordingly, it was assumed that the intra-ocular neoplasm was a metastatic carcinoma of the choroid, but histologic study of the enucleated eye demonstrated that it was, in fact, a typical melanosarcoma of the choroid.

SIGNIFICANCE OF ACCESSORY IMAGES AND ACCESSORY LIGHT FOR THE QUALITY OF THE RETINAL IMAGE. DR. COMBERG, Rostock.

It is known that accessory images and accessory light play a certain rôle even in normal conditions of vision. A more marked disturbance arises with irregular corneal astigmatism, incipient cataract and after-cataract. In this study, an attempt was made, first, to determine how large that part of the pupil used for sharp vision had to be in terms of the entire pupil to produce a sharp retinal image. A test can be made if one photographs, one above the other, the sharp and the indistinct picture, respectively, of a test chart and in a test series gradually reduces, by percentages, the time of exposure necessary to produce a sharp picture. It was possible to obtain a definitely recognizable sharp picture of even the smallest figures when the time of illumination of the sharp picture was only 1/19 that of the indistinct picture. The clearly perceptible picture could be seen with underdevelopment and with overdevelopment as well as with the normal procedure. Actually, the eye is under much more favorable physiologic conditions, as the human organ of vision has a special capacity, in consequence of physiologic contrast, for overcoming accessory illumination and accessory images.

EXPERIMENTAL PROOF OF HELMHOLTZ' THEORY OF ACCOMMODATION. DR. COMBERG, Rostock.

At the International Congress of Ophthalmology at Madrid in 1933 a patient, now 17 years of age, was presented who had a large (operative) coloboma and normal accommodative mechanism, which allowed the changes of the lens during accommodation to be observed and studied.

At the age of 8, this patient was operated on for a penetrating injury of the eye with prolapse of the iris. There is a large coloboma downward; the eye is free from astigmatism; vision is normal and accommodates (9 diopters) in accordance with the patient's age.

For demonstration, the light ray from the latest model of the slit lamp, with a slit 8 mm. high, is directed almost meridionally through the lens in an optical section close to the axis. It can be clearly seen that the changes in the form of the lens during accommodation are completely in accordance in all practical points with the Helmholtz theory. The lower equator of the lens approaches the optical axis noticeably when the eye focuses for near objects; the anterior surface of the lens bulges forward more markedly, and the posterior surface also shortens its radius of curvature, although the posterior pole does not move backward to any great extent. It is significant, and the observation is important, that the equator of the lens approaches the optical axis with accommodation and is again drawn toward the ciliary body when accommodation is relaxed. This shows with absolute certainty that the zonule is relaxed during accommodation.

CHANGES IN THE REGION OF THE BONY CANAL IN STEEPLE SKULL. DR. BEHR, Hamburg.

In an anatomic study of four cases of oxycephaly with atrophy of the optic nerve, the conclusion has been reached that the condition of the nerve is due to a choking within the optic canal which is caused not so much by a stenosis of the canal as by a shift of its wall. This anomaly is associated with an abnormally deep location of the middle fossa with a resulting steep inclination of the orbital roof. This causes a displacement of the roof of the bony canal backward over its floor. The internal carotid then gets under the roof with its fifth curve and causes a narrow strait through which the optic nerve must pass. The degree of narrowing of the canal determines the fate of the optic nerve. X-ray pictures and drawings of steeple skulls are presented which demonstrate that the abnormally low plane of the middle fossa becomes evident externally, as well, by a lowering of the external auditory meatus. It is only in such cases of oxycephaly that the optic nerve is involved.

DEMONSTRATION OF A FAMILY TREE. DR. VON HIPPEL, Göttingen.

This article concerns a genealogy with a sex-linked inheritance, the affected subjects showing nystagmus, strabismus, high myopia with amblyopia, hemeralopia, tubular visual fields without retinitis pigmentosa and no total color blindness.

A WOUND SPECULUM FOR USE IN OPERATIONS FOR RETINAL DETACHMENT. DR. ARRUGA, Barcelona.

The instrument consists of a holder which is much like the usual model for ophthalmic operations, except that the part which supports the terminal portion of the instrument is more massive. It has somewhat the form of a spoon midway between the usual Desmarre model and that of Vogt. This construction makes it possible to get as far back as the macula in cases of tear in this region, after previous section of the external rectus muscle. Similarly it can easily be applied under the other extra-ocular muscles when it is necessary to operate in their neighborhood.

A Peculiar Form of Corneal Degeneration (?). Dr. Meesmann, Berlin.

X-ray and slit-lamp pictures and histologic sections of the cornea of a woman, aged 64, with Bence-Jones albuminuria are demonstrated. In all of the corneal layers there were literally thousands of extremely minute, almost microscopic, homogeneous yellow particles. The surface of the cornea was quite smooth and clear, reflecting perfectly, so that the endothelium must be considered as having been normal. The deposits, which had been present for about six years, produced a dense uniform opacity of the cornea. This did not, however, interfere markedly with vision, which was comparatively good (5/7) in both eyes. A small bit of tissue removed for histologic examination showed the presence of fat, cholesterol and lime, and indicated that hyaline substance could be excluded. The reaction of the tissue to stains, the arrangement of the tiny droplets in the corneal stroma and the particular constitutional disease of the patient justify the assumption that in all probability the corneal deposits, too, consisted of Bence-Jones albuminous bodies.

Some Rare and Diagnostically Decisive Roentgen Findings in the Skull. Dr. Wessely, Munich.

Intracranial Arterial and Venous Racemose Angioma.—In a slender and very delicate young girl who has suffered since early childhood from frequent attacks of epileptiform convulsions and headache, there has developed in the course of the last year or two a marked left exophthalmos without pulsation but with dilatation and tortuosity of the conjunctival and ciliary vessels. The scalp of the left frontal region is thickened, and the temporal artery in this area is tortuous and dilated. The fundus of each eye presents a typical picture of tortuosity of the retinal vessels. On auscultation a blowing systolic murmur is heard all over the head, but the patient herself is not aware of this murmur. This symptom complex alone allows one, to begin with, to class the case definitely in the category, established notably by Cushing, of intracranial racemose angiomas. But the x-ray picture of the skull is still more striking and pathognomonic. The sulci for the meningeal arteries and veins, which are ordinarily faintly visible and more suggested than actually seen, present as convolutions of broad rarefaction bands in the bone of the skull, many of them anastomosing. It is evident that the dural vessels were concerned to a quite unusual degree in the formation of the racemose angioma, and the tortuosity of the vessels in the fundus may well be closely related etiologically to this factor—a point to be borne in mind and considered with greater attention in the future in the interpretation and diagnosis of such conditions.

Unilateral Atrophy of the Optic Nerve Presumably Due to a Small Basal Psammoma.—A perfectly healthy woman, aged 46, became completely blind in the left eye within two years from bland (sic) atrophy of the optic nerve. The cause was shown by stereoscopic roentgenography to be a hemispheric tumor, about 1 cm. in diameter, resting on the left anterior clinoid process directly at the inner aperture of the optic canal. The uniformity of the shadow and the sharp outline of the growth suggest, as the most probable diagnosis, psammoma of the

dura mater at the base of the skull. As to differential diagnosis, osteoma has also to be thought of, but osteoma of the base must be exceedingly rare, as it has hardly ever been observed.

Posterior Orbital Encephalocele.—In a little girl, now 9 years of age, there gradually developed, following birth, a marked bulging of the right temporal region and of the upper and outer margin of the orbit. There was extreme protrusion of the eyeball, which was crowded inward and downward, with marked distortion of the upper lid by a soft, elastic tumor mass which filled the back of the orbit. At the age of 8, signs of increased intracranial tension supervened, and an encephalogram showed marked internal hydrocephalus. A wide decompression of the right temporal squama, which was markedly rarefied in its middle portion, was followed by puncture of the ventricle and evacuation of 50 cc. of cerebrospinal fluid. The general symptoms then subsided, but the local condition remained unchanged. As a consequence of the bony defect, which was almost as large as one's palm, the stereoscopic x-ray pictures allow one to get an unusually clear picture of conditions in the interior of the skull. They show, in addition to the uniform dilation of the right orbit and the compression of all the accessory sinuses of the right side, an almost complete absence of the entire posterior (sic) bony wall of the orbit. There is no doubt that this is a case of posterior encephalocele, which with its unusually clear x-ray survey completes in many respects the picture of a rare anomaly which appears under the most varying forms.

Fat-Staining of the Retina in the Total Specimen: Dr. Kyrieleis, Hamburg.

Retinas which had presented intra vitam the picture of albuminuric retinitis were stained in the piece with scarlet red for histologic study of the relations of foci of exudations and hemorrhages to the possible presence of arterioles which had undergone fatty degeneration. It was not found possible to show a uniform and invariable dependence of the pathologic changes in the retina on definitely diseased vessels. These findings support the view that arteriosclerosis is not the cause of foci of exudations and hemorrhages in albuminuric retinitis but is a coordinate symptom of a disturbance of circulation in the peripheral blood stream.

Involvement of the Ocular Musculature in Thomsen's Disease. Dr. Kyrieleis, Hamburg.

In two cases of typical myotonia congenita there was found, in addition to an involvement of the orbicularis muscle, a persistence of contraction of both internal recti after extreme convergence but not after marked rotation of the globe inward or outward. One patient presented a sort of von Graefe sign on extreme sursumvergence. Besides, the intra-ocular musculature (sphincter iridis and ciliary muscle) was affected in varying degrees. It is a question whether these conditions can be fully explained by changes in the muscles themselves and whether one has not to consider, in addition, abnormal innervational influences as factors, to explain this clinical picture.

MIXED TUMOR OF THE ORBIT. DR. REICHLING, Berlin (Charité).

This neoplasm, which necessitated enucleation of the eyeball, consisted of (1) a cavernous hemangioma, which formed the main mass of the growth, (2) newly formed fat tissue and (3) newly formed true lymphadenoid tissue. In the newly formed lymphoid nodules there were centers of proliferation.

EMBOLISM OF THE CENTRAL ARTERY OF THE RETINA AND OF THE VASCULAR CIRCLE OF ZINN IN A CASE OF CARDIAC PSEUDOMYXOMA. DR. REICHLING, Berlin.

This case is particularly interesting because it adds one example to the exceedingly small number of cases of embolism of the retinal artery which have been studied histologically in an early stage. The retinal edema involves principally the nerve fiber layer and the internuclear layer. The indisputable demonstration of embolic obstruction in the vessels of Zinn's vascular ring is important in its bearing on the interpretation of the edema in the internuclear layer. This seems to be the first case of the kind in which there cannot be the slightest doubt as to the existence of embolic obstruction of the vessels mentioned.

UNUSUAL FINDINGS IN EXUDATIVE RETINITIS: A CONTRIBUTION TO THE PATHOLOGY OF THE CIRCULATION IN THE SMALLER RETINAL VESSELS. DR. SERR, Heidelberg.

A youth, aged 16, presented in a detached retina, which lay directly back of the lens, numerous vascular anomalies, especially miliary aneurysms. The finest details of the circulation of the blood could be observed with the slit lamp and studied in their entirety. These details are reported in the article, which will be published.

A CASE OF TORTUOSITY (ANGIOMATOSIS) OF THE RETINAL VESSELS. DR. JUNIUS, Bonn.

The right eye of a boy first seen at the age of 15 had been blind from early childhood or, in all probability, from birth. The fundus showed marked tortuosity of the arteries and veins as they emerged from or reached the disk. There was a striking lack of vascularity of the retina, and one was struck by the scarcity of visible small side ramifications of the vessels. This feature distinguished the case from those previously reported, in which there was, on the contrary, an apparent overabundance of visible small vessels. The fundus was of a very light shade, and the choroidal circulation was plainly visible. The disk was abnormally small, grayish white, i. e., atrophic, and diffusely bounded by a yellow conus, both nasally and temporally. The structure of the eye was myopic and astigmatic (sphere —6 diopters, cyl., —2 diopters). The other eye was emmetropic with full vision, but in this eye, too, the vessels running off nasally from the disk showed a slight tortuosity. These observations were made in a period of turmoil (1918), and the patient was not followed up. He died in 1933 at the age of 30. The fellow eye had remained normal. The patient had never noted serious headaches or convulsive attacks. He was intelligent and active as a farmer. Death was due to heart disease the exact nature and cause of which had not been made clear. The liver was extraordinarily large,

but postmortem examination did not reveal whether this increase in size was due to angiomatosis. In spite of the incomplete and somewhat indefinite observations, the case is instructive if it is considered in its broad relations. Angiomatosis of the retinal vessels is always an important diagnostic indication that one is dealing with a not fully or normally developed person. If indefinite symptoms of disease supervene in such a subject in the course of years, the intra-ocular changes will give one an indication as to whether one deals, according to the signs, with an angiomatosis of the cerebral vessels and/or of the liver, as was probable in this case, on the one hand, or with cyst formation in the pancreas, liver or other gland, respectively, on the other. Undoubtedly there are cases in which the retinal vascular tortuosity is the only symptom—a fortunate thing for the patient in the case—but even then the anomaly is a significant indication for the physician. A series of cases of this nature reported in the literature are also detailed.

BACTERIAL FINDINGS IN "HEALED" EXPERIMENTAL OCULAR TUBERCULOSIS. DR. WEGNER, Freiburg.

Several months after the clinical cure of experimentally produced chronic uveitis, microscopic sections showed in the deeper layers of the iris and choroid not only small infiltrates which could not be made out clinically, but tubercle bacilli as well. The micro-organisms were found not only in the infiltrates, but outside them, and even in the clinically healthy cornea. These observations explain two well known clinical occurrences: (1) the "flare-up" of specific inflammation in clinically healed tuberculous eyes after operative intervention and (2) the development of a relapse, without bacillemia from the eye. In the eye, as in other organs, tubercle bacilli may lead a saprophytic existence for years or probably for decades only to become virulent again as a result of factors which are to a great extent unknown.

KERATOPLASTY WITH CADAVERIC CORNEAL TISSUE. DR. NIŽETIĆ, Belgrade.

The question of the transplant in keratoplasty occupies the foreground, as homoplastic material is so hard to obtain. In this article cadaveric material is discussed, and what has become known in this regard is analyzed. The article deals, in particular, with the experience and successes of Filatoff, who reported two cases which he followed up for a long time and which appeared to show lasting success (fourteen months and seven months, respectively). In addition, a patient is presented in whose case use was made of the cornea of a young girl who died twenty hours previously. The patient has been under observation now for three months. The transplant is transparent. It is hoped that the use of cadaveric material for corneal transplants may prove successful and so widen the field of keratoplasty.

PROTECTION OF TEST CHARTS AGAINST DETERIORATION FROM EXTERNAL INFLUENCES ("ULTRAPHANATION"). DR. BÜCKLERS, Tübingen.

The process worked out by the firm of Georg Uehlin, Schöpfheim, Baden, allows printed matter to be covered with a thin transparent layer

of a substance which protects it against moisture, dust, sweat, fat, benzine, alcohol, etc. A thin sheet of this substance (Ultraphan) under a pressure of 400 atmospheres is stamped, while heated, on the underlying map or card and protects it permanently from deterioration.

CATARACT OCCURRING WITH SKIN DISEASES. DR. FRANCESCHETTI, Geneva.

Cataract is observed in association with a great variety of skin disorders. Those to be considered primarily are scleroderma, poikiloderma, neurodermatitis, myxedema and, in rare cases, alopecia and telangiectasis. The form of the cataract is typical only in the cases of neurodermatitis. Drawings are presented showing the typical shield form of the lens opacity, which is located at the anterior pole and bounded by arcuate lines, as originally described by Andogsky and later by Vogt, Löwenstein and others.

CASE 1.—A woman of 31, of a healthy family, had suffered since she was 1 year old with eczema, principally of the arms, neck and face. The disorder was pronounced a neurodermatitis according to the investigations of the dermatologic clinic at Basel. Anomalies of internal secretion are generally believed to be the important etiologic factor in neurodermatitis; the phenomena mentioned suggest that one is dealing, at least so far as the gonads are concerned, with a hyperfunction or dysfunction rather than with a hypofunction. Besides the opacity at the anterior pole of the lens there was another more diffuse clouding at the posterior pole with the iridescent play of colors characteristic of complicated cataract. There was a conspicuous absence of clefts, striations and other usual discontinuity of striae, so that the whole lens appeared quite homogeneous.

CASE 2.—A typical shield-form opacity with arcuate boundaries was observed in the left eye of a woman, aged 32, with generalized seborrheic eczema but without any signs of neurodermatitis. The cataract typical of the latter disease may, it thus appears, develop, as a rather rare exception, in a case of ordinary eczema. In the right eye there was a mature cataract. The narrow slit-lamp beam showed that the anterior surface of the lens was uneven, and that the capsule followed the clefts and valleys. At various points the capsular epithelium was missing, particularly below and temporally. This finding speaks in favor of the hypothesis that the damage which the lens has suffered originated in the domain of the capsular epithelium. The investigations of Müller and others indicate that the vitamins which, incidentally, show a close relation to the products of the glands of internal secretion, may also have a causal connection with cataract formation. Until these conditions are cleared up, one has to limit oneself to the statement that a typical shield-form opacity of the anterior pole of the lens occurs which in many cases is related to disorders of the skin and possibly to endocrine disturbances.

CHOKED DISK AND CEREBRAL EDEMA. DR. MARCHESANI, Munich.

There is a regular parallelism between papilledema and the condition often spoken of as "wet brain," not only in general but also and markedly in regard to the degree of the changes. Papillary stasis without

edema of the brain comes on shortly after decompressive procedures; edema of the brain, without papilledema, occurs in the incipient stage of increased intracranial tension. The mechanical pathologic factor is an increase in volume of the brain due to colloid imbibition. The optic nerve, too, undergoes, in papilledema, an increase in volume, which is recognizable by its constriction in the scleral canal and within the bony wall of the optic canal. The nerve substance swells in whatever direction it can. The brain mass swells into the cisternae; the optic nerve mass, into the globe. Both reactions are, at a certain stage, more marked on the side corresponding to the tumor. Whenever papilledema is absent or less on the side corresponding to the cerebral neoplasm, one is dealing with a direct "neighborhood" action of the tumor on the optic nerve. Neither the swelling of the brain nor the papilledema is due to actual edema, as no free fluid is found. The axis-cylinders and the glia cells, as well, are swollen and partially disintegrated by imbibition. The latter show, when stained according to Cajal's method, the phenomenon known as clasmatodendrosis. Held's glial cameral spaces are enlarged. This is particularly striking wherever the glia marginal tissue is markedly developed, as in vessels, trabeculae and septums and in the pial sheath coverings. The changes are present throughout the entire extent of the optic nerve as well as in the brain. This conception of the optic nerve changes as an integral partial phenomenon in a general swelling of the brain makes a special theory for the pathogenesis of papilledema superfluous. The mechanical factor is edema of the brain, not only in intracranial, i. e., cerebral disease, but also in other conditions accompanied by papilledema, e. g., uremia, in which the swelling of the optic nerve head is brought about indirectly by edema of the brain. In orbital disease this is to be considered as a localized edema of the brain, analogous to the effusion and imbibition in the immediate vicinity of various pathologic processes in the brain.

A Case of Metastatic Orbital Glioma Cured by Exenteration. Dr. Kapuscinski Jr., Posen.

A boy, aged 2, had a glioma in the first stage and hyphemia. First, a paracentesis of the anterior chamber was made to make sure of the diagnosis. Enucleation followed, six days later. In spite of the fact that microscopic examination failed to reveal glioma cells in cross-sections of the nerve stem, there was a recurrence of the glioma in the orbit a half year later. Following exenteration and roentgen therapy, there was complete healing, which was still noted after eighteen months, so that the condition may be considered cured in the absence of local regional metastatic deposits. Histologic examination showed a glioma nodule, the size of two peas, which partially infiltrated the nerve head without, however, breaking through the lamina cribrosa. The sclera was found intact in all the serial sections, and the lymph sheaths of the vorticose veins as well as the channels and exits of the ciliary nerves were free from glioma cells. There was an "enormous" infiltration of the ciliary body and a similar, less marked involvement of the iris. Numerous glioma cells which were well stained, and accordingly viable (*lebensfrisch*), were found in the anterior chamber and on the posterior surface of the cornea. The puncture wound of the anterior chamber

showed a partial incarceration of iris tissue in the form of fresh tumor cells. It is assumed that the cells forming the metastasis reached the orbit by way of the paracentesis at the limbus. The opinion seems justified that it would be wise to omit diagnostic surgical procedures which open up the globe unless enucleation follows immediately.

THE ZEISS PHOTONYSTAGMOGRAPH. DR. WIEDERSHEIM, Saarbrücken.

The apparatus as now constructed, with a number of improvements, meets admirably all the demands which were formulated when the first model of this instrument was demonstrated. The apparatus and some graphs obtained with it were demonstrated (cf. previous communication, *Klin. Monatsh. f. Augenh.*, vols. 80, 83, 86 and 88).

SOME UNUSUAL DISTURBANCES OF MOTILITY. DR. BIELSCHOWSKY, Breslau.

The clinical picture of so-called anterior internuclear ophthalmoplegia proves that supranuclear lesions are capable of producing not only bilateral paralyses of associated muscles or muscle groups, but also unilateral or bilateral paralyses of muscles which are not associated in motion in a given direction. An observation of this kind was reported before this society in 1902 and photographs were shown of a female patient with complete loss of function of the interni on both sides for parallel (homonymous) motions and perfect preservation of convergence and of the function of the two external recti. The disturbance had come on suddenly and was probably to be explained by, and was due to, a small hemorrhage in the posterior (dorsal) longitudinal fasciculus. After fourteen days there was a decided improvement in the action of the interni in "parallel" ductions. The supranuclear origin of unilateral paralyses can only be demonstrated, in addition, in involvement of the levator muscles of the globe by testing Bell's phenomenon. I have seen three cases of this nature and included the photograph of one patient in my chapter, "Disturbances of Ocular Motility," in the Graefe-Saemisch handbook. The pictures now shown are those of a patient with a large intracranial tumor which, to judge from the x-ray picture, has completely destroyed the large wing of the sphenoid and the sella turcica. The clinical symptoms point to a lesion of the nerve stems. Bilateral, almost complete, ophthalmoplegia, and severe damage to both optic nerves resulting in absolute amaurosis of one eye and marked loss of vision with concentric contraction of the field of vision in the other, as well as involvement of the trigeminus, are evident. A small remnant of rotation downward is all that is left of ocular motility. With an impulse stimulus to rotation upward, the right eye does not respond, and the left responds but slightly. With an impulse to lid closure, the right eye remains stockstill in the median position, while the left proceeds to maximal upward rotation. Hence it follows that the nuclei and nerves for the levators of the left eye must be intact, and that only the innervation paths from the cortex have lost their function of conduction. A part of the tumor must have compressed the corpora quadrigemina but has until now spared, on the left side, the paths which mediate Bell's phenomenon, a reaction which is particularly resistant to pathologic change, as is known from observations on associated paralyses of fixation upward.

Book Reviews

Report of the Committee of Inquiry into Problems Relating to Partially Sighted Children. By the London Board of Education. Price, 3 shillings net. Pp. 200. London: His Majesty's Stationery Office, 1934.

This report treats of the education of partially sighted children.

In 1908, the first experimental "myope class" in London was started. The initiation and development of this system of special education was due chiefly to Mr. Bishop Harman, ophthalmologist to the London County Council, and Dr. James Kerr, school medical officer of London.

The preference of the committee is for schools for the "partially sighted," as the term "myope class" indicates too limited a group; the term "partially blind" is psychologically bad, and the term "sight-saving class" (as used in the United States) is considered to claim too much.

Myopia is the most important and most frequent single condition leading to admission to these schools. The conclusions reached with regard to myopes were:

1. If the eyes show changes in the fundus indicative of a serious condition of myopia, the child should always be admitted to a special school.

2. In the absence of changes in the fundus the child should usually be admitted to a special school (*a*) if the myopia is definitely increasing at a rate of more than 1 diopter yearly or (*b*) if after a period of slow increase or apparent arrest, there is a sudden rise in the rate of progress to more than 2 diopters a year.

3. The actual amount of myopia should not be the sole factor in determining whether a child should be sent to a special school.

4. The younger the child the more serious are such factors as the amount and the rate of progress of the myopia. The existence of a history of myopia in the family may be a deciding factor.

4. Myopic children with vision of 6/24 or less should be admitted to a special school. Most of these will fall within category 1.

In postinflammatory conditions vision of 6/24 or less, with near vision of ability to read Jaeger's test type no. 8 or no. 10, is an indication for admission to a special school. Cases of optic atrophy are most difficult to assess.

It is suggested that the selection of children for admission to these classes be made only by ophthalmologists. The incidence of these cases in England and Wales is approximately 0.1 per cent of the total number of children registered. Periodic examination should be made every six months and should include examination of those who may have been transferred from the special school to an ordinary school. In general, the special classes should be attached to the ordinary school. There should be no association with schools for the blind. It is recom-

mended that books be used sparingly by children under the age of 8 years, and that the main work be done on blackboards. When books are necessary, they should be printed in 24-point type. For older children 18-point type may be allowable. Handiwork and physical training must be considered, as well as the training of teachers for these classes.

The committee is averse to specific vocational training, such as is common in schools for the blind; the aim should be to educate the pupils, as far as possible, to compete on equal terms with other persons (*British Medical Journal*, July 14, 1934, page 68).

W. F. DUGGAN.

Directory of Ophthalmologic Societies *

INTERNATIONAL

International Association for Prevention of Blindness

President: Prof. F. de Lapersonne, 217 Faubourg St. Honoré, Paris.
Secretary-General pro tem: Dr. A. Churchill, 66 Boulevard St. Michel, Paris.

International Ophthalmologic Congress

Secretary: Dr. Francisco Poyales, Olozaga 3, Madrid.
Place: Cairo. Time: 1937.

FOREIGN

British Medical Association, Section on Ophthalmology

President: Dr. A. J. Ballantyne, 11, Sandyford Pl., Glasgow, C 3.
Secretary: Dr. J. Ringland Anderson, 108 Collins St., Melbourne.
Place: Melbourne. Time: Sept. 11-13, 1935.

Ophthalmology Society of Bombay

President: Dr. D. D. Sathaye, 127 Girgaum Road, Bombay 4.
Secretary: Dr. H. D. Dastur, Dadar, Bombay 14.
Place: H. B. A. Free Ophthalmic Hospital, Parel, Bombay 12. Time: First Friday of every month.

Ophthalmological Society of the United Kingdom

President: Mr. R. Foster Moore, 53, Harley St., London, W. I.
Secretary: Miss Ida Mann, 7, Wimpole St., London, W. I.

Oxford Ophthalmological Congress

Master: Dr. C. G. Russ Wood, Hill House, Abberbury Rd., Iffley, Oxford, England.
Hon. Secretary-Treasurer: Dr. F. A. Anderson, 12 St. John's Hill, Shrewsbury, England.
Place: Oxford. Time: July 4-6, 1935.

Royal Society of Medicine, Section of Ophthalmology

President: Dr. Ransom Pickard, 31, East Southernhay, Exeter, England.
Secretary: Dr. J. D. Magor Cardell, 27, Weymouth St., London, W. 1.

Société Française d'Ophthalmologie

Secretary: Dr. René Onfray, 6 avenue de la Motte Picquet, Paris 7è.

Society of Swedish Ophthalmologists

President: Prof. F. Berg, Uppsala, Sweden.
Secretary: Dr. K. O. Granström, Södermalmstorg 4 III tr., Stockholm, Sö., Sweden.

German Ophthalmological Society

Secretary: Prof. A. Wagenmann, Heidelberg.

NATIONAL

American Medical Association, Scientific Assembly, Section on Ophthalmology

Chairman: Dr. Arthur J. Bedell, 344 State St., Albany, N. Y.
Secretary: Dr. Parker Heath, 1553 Woodward Ave., Detroit.
Place: Atlantic City, N. J. Time: June 10-14, 1935.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Wells P. Eagleton, 15 Lombardy St., Newark, N. J.
President-Elect: Dr. Frank E. Burch, 408 Peter St., St. Paul.
Executive Secretary-Treasurer: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Cincinnati. Time: Sept. 16-20, 1935.

AMERICAN OPHTHALMOLOGICAL SOCIETY

President: Dr. Walter B. Lancaster, Boston.
Secretary-Treasurer: Dr. J. Milton Griscom, 2213 Walnut St., Philadelphia.
Place: Hot Springs, Va. Time: June 5-7, 1935.

NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS

President: Mr. William Fellowes Morgan, 50 W. 50th St., New York.
Managing Director: Mr. Lewis H. Carris, 50 W. 50th St., New York.

SECTIONAL

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

President: Dr. James J. Regan, 520 Commonwealth Ave., Boston.
Secretary-Treasurer: Dr. Benjamin Sachs, 483 Beacon St., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY

President: Dr. Frank B. Kistner, Mayer Bldg., Portland, Ore.
Secretary-Treasurer: Dr. Frederick C. Cordes, 384 Post St., San Francisco.
Place: Portland, Ore. Time: May 20-23, 1935.

PUGET SOUND ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Francis A. Brugman, 509 Olive St., Seattle.
Secretary-Treasurer: Dr. Noble Dick, 1115 Terry Ave., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

ROCK RIVER VALLEY EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. Harry Shearer, 405 E. Grand Ave., Beloit, Wis.
Secretary-Treasurer: Dr. W. S. Beyer, 1101 Talcott Bldg., Rockford, Ill.
Place: Rockford, Ill., Janesville or Beloit, Wis. Time: Third Tuesday of each month.

SAGINAW VALLEY ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Charles H. Baker, 805 Washington Ave., Bay City, Mich.
Secretary-Treasurer: Dr. W. K. Slack, 308 Eddy Bldg., Saginaw, Mich.
Place: Saginaw, Mich., or Bay City, Mich. Time: First Friday of each month, except July and August.

SIOUX VALLEY EYE AND EAR ACADEMY

President: Dr. J. J. Hompes, 1307 N St., Lincoln, Nebr.
Secretary-Treasurer: Dr. J. C. Decker, Francis Bldg., Sioux City, Iowa.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. William A. Wagner, 914 American Bank Bldg., New Orleans.
Secretary: Dr. O. M. Marchman, Medical Arts Bldg., Dallas, Texas.
Place: St. Louis. Time: November 1935.

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President: Dr. F. B. Fralich, 203 S. Main St., Ann Arbor, Mich.
Secretary-Treasurer: Dr. A. S. Barr, 201 S. Main St., Ann Arbor, Mich.
Time: Third Thursday of alternate months.

WESTERN PENNSYLVANIA EYE, EAR, NOSE AND THROAT SOCIETY
President: Dr. Claude W. McKee, 229 S. Main St., Greensburg.
Secretary-Treasurer: Dr. C. W. Beals, 41 N. Brady St., DuBois.
Place: Indiana. Time: October 1935.

STATE

COLORADO OPHTHALMOLOGICAL SOCIETY
President: A presiding officer is selected for each meeting alternately until all members have served.
Secretary: Dr. Edna M. Reynolds, 227, 16th St., Denver.
Place: Capitol Life Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT
President: Dr. Arthur M. Yudkin, 257 Church St., New Haven.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.
Time: May, November.

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA
President: Dr. Herschel C. Crawford, 26 Lindon Ave., N. E., Atlanta.
Secretary-Treasurer: Dr. J. A. Smith, 700 Spring St., Macon.
Place: Atlanta. Time: May 7-10, 1935.

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY
President: Dr. Ora G. Brubaker, North Manchester.
Secretary: Dr. Frederick V. Overman, 705 Hume-Mansure Bldg., Indianapolis.
Place: Indianapolis. Time: April 10, 1935.

IOWA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY
President: Dr. F. W. Dean, 532, 1st Ave., Council Bluffs.
Secretary-Treasurer: Dr. O. L. Thorburn, 213½ Main St., Ames.
Place: Council Bluffs. Time: 1935.

MICHIGAN STATE MEDICAL SOCIETY, SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
Chairman: Dr. John W. Orr, 503 S. Saginaw St., Flint.
Secretary: Dr. D. R. Heetderks, 26 Sheldon Ave., S. E., Grand Rapids.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY
President: Dr. James A. Reynolds, 78 S. 9th St., Minneapolis.
Secretary-Treasurer: Dr. Walter E. Camp, Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month from October to May.

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY
President: Dr. Lawrence G. Dunlap, 101 Main St., Anaconda.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.

NEW JERSEY STATE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY, OTOLOGY AND RHINOLARYNGOLOGY
Chairman: Dr. James A. Fisher, 501 Grand Ave., Asbury Park.
Secretary: Dr. William K. Campbell, 96 Third Ave., Long Branch.

NEW YORK STATE MEDICAL SOCIETY, EYE, EAR, NOSE AND THROAT SECTION
Chairman: Dr. Webb W. Weeks, 20 E. 53rd St., New York.
Secretary: Dr. John F. Fairbain, 925 Delaware Ave., Buffalo.
Place: Albany. Time: May 13-15, 1935.

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY
President: Dr. W. R. Winn, 702 First Ave., S., Fargo.
Secretary-Treasurer: Dr. F. L. Wicks, 516 Fourth St., Valley City.
Place: Minot. Time: June, 1935.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. A. B. Dykman, Medical Dental Bldg., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

Acting President: Dr. Nathan Bolotow, 108 Waterman St., Providence.
Secretary and Treasurer: Dr. Gordon J. McCurdy, 122 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Josiah E. Smith, 60 Meeting St., Charleston.
Secretary: Dr. J. W. Jervey Jr., 101 Church St., Greenville.

TENNESSEE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Eugene Orr, 706 Church St., Nashville.
Secretary-Treasurer: Dr. W. D. Stinson, 248 Madison Ave., Memphis.

TEXAS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. T. E. Fuller, 100 W. Broad St., Texarkana, Texas.
Secretary: Dr. O. M. Marchman, 1719 Pacific Ave., Dallas.

UTAH OPHTHALMOLOGICAL SOCIETY

President: Dr. William Stookey, 54 E. South Temple St., Salt Lake City.
Secretary-Treasurer: Dr. T. F. Welsh, 711 Boston Bldg., Salt Lake City.
Time: Third Monday of each month.

VIRGINIA SOCIETY OF OTO-LARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. Beverley R. Kennon, 142 W. York St., Norfolk.
Secretary-Treasurer: Dr. George G. Hankins, Medical Arts Bldg., Newport News.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. W. F. Beckner, 1050 Fifth Ave., Huntington.
Secretary: Dr. F. O. Marple, First Huntington National Bank Bldg., Huntington.
Place: Wheeling. Time: May 1935.

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Alfred Stahl, 55 Lincoln Park, Newark, N. J.
Secretary: Dr. A. Russell Sherman, 671 Broad St., Newark.
Place: 91 Lincoln Park South, Newark. Time: 8:45 p. m., second Monday of each month, October to May.

ATLANTA EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. Herschel Crawford, 478 Peachtree St., N. E., Atlanta, Ga.
Secretary: Dr. Stacy C. Howell, 384 Peachtree St., N. E., Atlanta, Ga.
Place: Academy of Medicine, 13 Queen's Park. Time: 8 p. m., last Thursday of each month.

BALTIMORE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY

Chairman: Dr. Lloyd B. Whitham, Mt. Vernon Pl. and Charles St., Baltimore.
Secretary: Dr. Mary L. Small, 18 W. Read St., Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

Brooklyn Ophthalmological Society

President: Dr. John H. Bailey, 855 St. Marks Ave., Brooklyn.
Secretary-Treasurer: Dr. George Freiman, 703 Grand St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday in February, April, May, October and December.

Buffalo Ophthalmologic Club

President: Dr. H. H. Glosser, 448 Franklin St., Buffalo.
Secretary-Treasurer: Dr. I. J. Koenig, 40 North St., Buffalo.
Time: Second Thursday of each month.

Chicago Ophthalmological Society

President: Dr. E. V. L. Brown, 122 S. Michigan Ave., Chicago.
Secretary-Treasurer: Dr. Thomas D. Allen, 122 S. Michigan Ave., Chicago.
Place: Medinah Michigan Avenue Club, 505 N. Michigan Ave. Time: Third Monday of each month from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Otolaryngology

Chairman: Dr. A. D. Ruedemann, 2020 E. 93d St., Cleveland.
Secretary: Dr. Fred W. Dixon, 1029 Rose Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

Cleveland Ophthalmological Club

Chairman: Dr. W. P. Chamberlain, 7405 Detroit Ave., Cleveland.
Secretary: Dr. A. D. Ruedemann, Cleveland Clinic, Cleveland.

College of Physicians, Philadelphia, Section on Ophthalmology

Chairman: Dr. John Milton Griscom, 2213 Walnut St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

Columbus Ophthalmological and Oto-Laryngological Society

Chairman: Dr. W. C. Davis, 327 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. H. M. Sage, 9 Buttles Ave., Columbus, Ohio.
Place: Athletic Club. Time: First Monday of each month.

Dallas Academy of Ophthalmology and Oto-Laryngology

President: Dr. W. Mood Knowles, 1719 Pacific Ave., Dallas, Texas.
Secretary: Dr. L. H. Quinn, 4015 Live Oak St., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. C. C. Walker, 410 6th Ave., Des Moines, Iowa.
Secretary-Treasurer: Dr. Grace Doane, 614 Bankers Trust Bldg., Des Moines, Iowa.
Time: 7:45 p. m., third Monday of every month, September to May.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.
Secretary: Dr. Raymond S. Goux, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. Arthur F. Holding, 142 Washington Ave., Albany.
Secretary-Treasurer: Dr. W. C. Mott, 214 State St., Albany.
Time: Third Wednesday in October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. T. L. Goodman, 602 W. 10th St., Fort Worth, Texas.
Secretary-Treasurer: Dr. Van D. Rathgeber, 1012 Medical Arts Bldg., Fort Worth.
Place: Medical Hall, Medical Arts Bldg. Time: 7:30 p. m., first Friday of each month except July and August.

Grand Rapids Eye, Ear, Nose and Throat Society

President: Dr. John H. McRae, 26 Sheldon Ave., S. E., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Robert G. Laird, 307 Metz Bldg., Grand Rapids, Mich.
Place: Various local hospitals. Time: Third Thursday of alternating months, September to May.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. R. M. Hargrove, 1202 Esperson Bldg., Houston, Texas.
Secretary: Dr. J. C. Dickson, 1617 Medical Arts Bldg., Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., second Thursday of each month from September to June.

Indianapolis Ophthalmological and Otolaryngological Society

President: Dr. C. H. McCaskey, 404 Continental Bank Bldg., Indianapolis.
Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Oto-Laryngology

President: Dr. Raymond E. Teall, 1103 Grand Ave., Kansas City, Mo.
Secretary: Dr. A. W. McAlester, 2003 Bryant Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

Chairman: Dr. Russell T. Uhls, 110 Pine Ave., Long Beach, Calif.
Secretary-Treasurer: Dr. Kenneth C. Brandenburg, 707 Security Bldg., Long Beach, Calif.
Place: Professional Bldg. Time: Last Wednesday of each month from October to May.

Los Angeles Society of Ophthalmology and Oto-Laryngology

President: Dr. F. H. Brandt, 1136 W. Sixth St., Los Angeles.
Secretary-Treasurer: Dr. Pierre Viole, 1930 Wilshire Blvd., Los Angeles.
Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd. Time: 6:30 p. m., fourth Monday of each month from September to May, inclusive.

Louisville Eye, Ear, Nose and Throat Society

President: Dr. Charles Dwight Townes, 332 W. Broadway, Louisville, Ky.
Secretary-Treasurer: Dr. J. S. Bumgardner, 1103 Heyburn Bldg., Louisville, Ky.
Place: French Village. Time: 6:30 p. m., second Thursday of each month from September to May, inclusive.

Medical Society of the District of Columbia, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. R. S. Pendexter, 900, 17th St., N. W., Washington.
Secretary: Dr. Lyman B. Tibbets, 1801 Eye St., N. W., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month from October to April, inclusive.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, 130 Madison Ave., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

MILWAUKEE OTO-OPHTHALMIC SOCIETY

President: Dr. J. J. Brook, 231 W. Wisconsin Ave., Milwaukee.
Secretary-Treasurer: Dr. Herbert G. Schmidt, 238 W. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., second Tuesday of each month from October to May, inclusive.

MONTREAL OPHTHALMOLOGICAL SOCIETY

President: Dr. J. A. MacMillan, 1410 Stanley St., Montreal, Canada.
Secretary: Dr. A. L. Guertin, 410 Sherbrooke St., West, Montreal, Canada.
Time: Second Thursday of October, December, February and April.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman: Dr. Wesley Wilkerson, Bennie Dillon Bldg., Nashville, Tenn.
Secretary-Treasurer: Dr. Hale Cullom, Bennie Dillon Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month from October to June.

NEW ORLEANS OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY

President: Dr. R. H. Fisher, Chess and Checker Club, New Orleans.
Secretary-Treasurer: Dr. H. F. Brewster, 837 Gravier St., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

Chairman: Dr. Webb William Weeks, 20 E. 53d St., New York.
Secretary: Dr. Guernsey Frey, 121 E. 60th St., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

OMAHA AND COUNCIL BLUFFS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. John H. Judd, 107 S. 17th St., Omaha.
Secretary-Treasurer: Dr. Robert H. Rasgorshek, 425 Aquila Court, Omaha.
Place: Omaha Club, 20th and Douglas Sts., Omaha. Time: 6 p. m., dinner; 7 p. m., program; third Wednesday of each month from October to May.

PHILADELPHIA COUNTY MEDICAL SOCIETY, EYE SECTION

Chairman: Dr. Charles R. Heed, 1205 Spruce St., Philadelphia.
Secretary: Dr. Sidney L. Olsho, 235 S. 15th St., Philadelphia.
Time: First Thursday of each month from October to May.

PITTSBURGH OPHTHALMOLOGICAL SOCIETY

President: Dr. Edward B. Heckel, 500 Penn Ave., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

PITTSBURGH SLIT-LAMP SOCIETY

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: 121 University Pl. Time: Second Monday evening of every month, except June, July, August and September.

RICHMOND OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. Samuel M. Cottrell, 116 E. Franklin St., Richmond, Va.
Secretary: Dr. Richard W. Vaughan, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

President: Dr. Frank Barber, 75 S. Fitzhugh St., Rochester, N. Y.
Secretary-Treasurer: Dr. Laurence Macey, 221 Alexander St., Rochester, N. Y.
Place: Rochester Medical Association, 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. Meyer Wiener, 308 N. 6th St., St. Louis.
Secretary: Dr. W. M. James, Metropolitan Bldg., St. Louis.
Place: Oscar Johnson Institute. Time: Clinical meeting 5:30 p. m., dinner and scientific meeting 6:30 p. m., fourth Friday of each month from October to April, inclusive, except December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Robert E. Parrish, 712 Medical Arts Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. Frank Steed, Nix Professional Bldg., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Frank H. Rodin, 490 Post St., San Francisco.
Secretary: Dr. Louis F. Morrison, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco.
Time: Fourth Tuesday of every month except May, June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. W. L. Atkins, 940 Margaret Pl., Shreveport, La.
Secretary-Treasurer: Dr. Leon F. Gray, 1214 Slattery Bldg., Shreveport, La.
Place: 1240 Texas Ave. Time: 8:15 p. m., fourth Tuesday of every month except June, July and December.

Spokane Academy of Ophthalmology and Oto-Laryngology

President: Dr. Marc Anthony, 422 Riverside Ave., Spokane, Wash.
Secretary: Dr. Raymond A. Lower, 1455 Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. D. F. Gillette, 109 S. Warren St., Syracuse, N. Y.
Secretary-Treasurer: Dr. W. J. Werfelman Jr., 725 State Tower Bldg., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

Toronto Academy of Medicine, Section of Ophthalmology

Chairman: Dr. Clarence E. Hill, 160 Bloor St., West, Toronto.
Secretary: Dr. A. Lloyd Morgan, 86 Bloor St., West, Toronto.
Time: First Monday, November to April.

Washington, D. C., Ophthalmological Society

President: Dr. William Thornwall Davis, 927 Farragut Sq., Washington, D. C.
Secretary-Treasurer: Dr. James N. Greear Jr., 1740 M St., N. W., Washington, D. C.
Place: Episcopal Eye and Ear Hospital. Time: 8 p. m., first Thursday in November, January, March and May.